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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 43

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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 43

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UDC 621.375

AN INTEGRATED-CIRCUIT MICROPHONE AMPLIFIER FOR TELEPHONE COMMUNICATION

Warsaw ARCHIWUM ELEKTROTECHNIKI in Polish Vol 26, No 4, Oct-Dec 78 pp 857-861
manuscript received 15 Dec 76

WISOWSKI, JANUSZ; STOLARSKI, EDWARD and CZERWINSKI, ANDRZEJ, Institute of Electronic Technology NPCP [Scientific-Production Center for Semiconductors]

[Abstract] An electronic microphone consisting of a dynamic cartridge and an integrated-circuit amplifier has been developed for domestic production, to compete in terms of cost and time drift with piezoelectric devices manufactured by Philips and Siemens. The amplifier circuit is essentially a monolithic one, with two transistors in the super-alpha connection and a diode bridge. Both the common-collector input stage and the common-emitter output stage are symmetric. Two external capacitors are needed: one for reducing the negative feedback and filtering out supply voltage fluctuations, one for symmetric control from a source with a low d-c resistance. The performance characteristics of this amplifier are in most aspects superior to those of a carbon microphone: the voltage gain is at least 50 dB, the frequency characteristic is flat within 4 dB over the 300-3400 Hz telephone band, the nonlinear distortion is smaller than 2 percent, and the psophometric noise does not exceed 750 mV across a 700 ohm load resistor. With the two capacitors properly matched, the frequency characteristic also becomes flat over the 250-20,000 Hz audio band. The amplifier operates with a supply current of 10-100 mA and delivers an output voltage of 5-7 V. It operates at temperatures from -10 to +40°C and can be stored at temperatures from -40 to +70°C. Figures 7; references 3: 2 Polish; 1 Western.

USSR

UDC 538.576.2

CONCERNING THE FIELD OF A DIRECTED RADIATOR IN AN ANISOTROPIC MEDIUM

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 6, 1978 pp 879-887 manuscript received 16 Feb 77

BELENOV, A. F. and KONDRAT'YEV, I. G.

[Abstract] The structure is studied of the field of a directed radiator which is described by a specified current distribution at a plane aperture, in a homogeneous anistropic medium with the existence of caustic directions. (The case of a medium with resonant special directions requires individual consideration, generally speaking beyond the scope of the description considered in the paper--e.g., it requires calculation of spatial dispersion.) Principal attention is focused on a discussion of the possibility of the use of such important and customary characteristics of a (vacuum) radiator as the radiation pattern and the coefficient and the directive gain for detection of radiation fields in an anistropic medium. Figures 2; references 11: 8 Russian; 3 Western.

USSR

UDC 621.317.729.3

MEASUREMENT OF ANTENNA RADIATION PATTERNS AFFECTED BY REFLECTION OF THE WAVE FROM THE GROUND (WITH THE USE OF AN AUXILIARY 'GROUND' ANTENNA)

Moscow RADIOTEKHNIKA in Russian Vol 33, No 6, Jun 78 pp 71-79 manuscript received 18 Jul 77

VOL'PERT, A. R.

[Abstract] The measurement of antenna radiation patterns will generally be distorted by superposition of forward waves and waves reflected from the earth's surface, which may be regarded here as a plane. It is theoretically possible to locate the auxiliary transmitting (measuring) antenna relative to the main receiving (measured) antenna so as to eliminate the effect of these reflections from the ground and thus simulate an antenna in free space. An analysis of this possibility indicates that the main antenna must be taller than the auxiliary antenna and all waves must arrive at it from one direction. With regard to the latter requirement, the error caused by nonparallelism, i.e., of finite distance from the auxiliary antenna, is evaluated here. The analysis is based on two nonparallel rays and the criteria for attenuating their effect on the reception in two directions. Conditions for amplitude and phase uniformity at the receiving antenna are established and related to the dimensions of the latter. Figures 5; references 3: Russian.

USSR

UDC 621.396.67

AN ALGORITHM FOR DIGITAL PROCESSING OF SIGNALS FOR PLOTTING THE RADIATION PATTERN OF RECEIVER ANTENNA ARRAYS

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 59-65 manuscript received after completion, 15 Jan 78

BOGACHEV, A. S.

[Abstract] An algorithm is developed for plotting the radiation pattern of a three-dimensional receiver antenna array with the aid of a digital computer. Such an array of arbitrary configuration is considered which consists of N directional or nondirectional elements each at a given distance from the origin of the spherical coordinates. The general expression for the gain distribution, with all elements having identical phase characteristics, can be simplified in the case of linear or planar arrays. Shifting and distributing the phase over the receiver antenna for proper side lobe levels by analog methods is equivalent to multiplying a signal by complex-conjugate weighting coefficients. Implementation of this algorithm is further considered in terms of apparatus and circuitry operating with binary codes.. Already 3-digit codes are found to yield a sufficient accuracy and to ensure almost inertialess automatic control of the directivity and the side lobes. While this algorithm can also be employed for space-time selection of signals, it requires a high-speed computer with a large storage capacity. Figures 4; references: 2 Russian.

USSR

UDC 621.396.67

SPECIAL FEATURES IN THE ALGORITHM FOR CALCULATING THE RADIATION PATTERN OF FULLY ROTATABLE REFLECTOR ANTENNAS WITH NONINTERSECTING AXES OF ROTATION FROM FIELD INTENSITY MEASUREMENTS WITHIN THE FRESNEL ZONE

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 7, Jul 78 op 1065-1067 manuscript received 14 Mar 77

SYSOYEV, YU. V.

[Abstract] The surface of field intensity measurements within the Fresnel zone of fully rotatable antennas with nonintersecting axes of rotation is an ellipsoid. Corrections are thus appropriate, if the field intensity is measured by azimuthal scanning over a sphere within the Fresnel zone. Accordingly, a relation has been established here between the discrete radiation pattern of such an antenna and the field intensity matrix. This relation becomes part of the algorithm for calculating the radiation pattern from measurements. Figures 3; references: 1 Russian.

USSR

UDC 621.396.67.001.2

INFLUENCE THAT FLUCTUATING THERMAL EMISSION OF A SEMICONDUCTIVE MEDIUM HAS ON THE SENSITIVITY OF A RADIO RECEIVER LOCATED IN THE MEDIUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 73 pp 1313-1314 manuscript received 12 Nov 76

VENDIK, O. G., ZAYONCHKOVSKIY, A. YA. and SOLOKHIN, A. V.

[Abstract] An investigation is made of the influence that thermal noises of an ambient semiconductive medium have on the maximum attainable sensitivity of a radio receiver. Two types of antennas are compared: an electric and a magnetic dipole enclosed in spherical dielectric shells. It is assumed that the shell is surrounded by an infinite isotropic semiconductive medium. The limiting case is considered where the noise intensity in the antenna is determined solely by the thermal radiation of the ambient medium. An expression is found for the maximum signal-to-noise ratio of the receiver. Formulas for the ratio of emission impedance to antenna resistance are derived for the two types of antennas. An example is given of quantitative evaluation of the influence of thermal radiation on radio signal reception in sea water. Curves are given showing the frequency dependence of the depth h_k at which the emf of noise of tropospheric and magnetospheric origin becomes equal to that of thermal emission of the water. Figures 2; references 5: 4 Russian; 1 Western.

USSR

UDC 621.396.67:537.874.6

THE DIFFRACTION FIELD OF AN INFINITE MULTILAYERED GRATING IN THE NEAR ZONE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1294-1296 manuscript received 30 Sep 76

POPOVIDI, R. S. and TSVERIKMAZASHVILI, Z. S.

[Abstract] The method of nonorthogonal series is used to solve the problem of diffraction of an E-polarized planar electromagnetic wave by an infinite multilayered grating of cylinders for arbitrary wave incidence. An expression is given which describes the diffraction field, and it is shown that the amplitudes and phases can be determined in the near and far zones. An analysis is made of near fields for the special case of a two-layer grating with normal wave incidence (although the algorithm is not limited with respect to number of layers or angle of incidence). The proposed technique is applicable to contacting and intersecting layers as well. The results of analysis and

comparison with other research show that other things being equal, the distribution of the amplitude and phase of the diffraction field in the near zone is independent of the shape of the elements of the grating. Figures 4, references: 7 Russian.

USSR UDC 621.396.677.4

AMPLITUDE-FREQUENCY CHARACTERISTICS OF A PATTERN-SHAPING BUTLER ARRAY WITH DIRECTIONAL COUPLERS ON COUPLED LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1076-1078 manuscript received 4 Jan 76; after revision 8 Jun 77

SHEPELYANSKIY, L. A. and SHEVCHENKO, P. P.

[Abstract] The authors consider phased pattern-shaping Butler antennas at bandwidths where amplitude nonuniformity of the distribution of electromagnetic energy among the outputs of the array begins to distort the radiation patterns. It is shown that for most output branches of such an array using quarter-wavelength directional couplers on coupled lines, the amplitude nonuniformity is considerably lower than the maximum, which has only two corresponding outputs. The square of the normalized wave impedance corresponding to minimum pattern distortion is plotted as a function of the coefficient of coverage of the working band. The maximum ratio between the absolute values of the propagation factors for any two outputs is plotted as a function of the coverage coefficient for different numbers of directional couplers. Figures 2; references 7: 5 Russian, 2 Western.

USSR UDC 621.396.677.49.001.5

ADAPTIVE METHODS OF SUPPRESSING INTERFERENCE IN COMMUTATION ANTENNA ARRAYS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1152-1163 manuscript received 26 Oct 76

ABRAMOVICH, YU. I. and ANILOV, B. G.

[Abstract] An examination is made of a stochastic approximation of algorithms for optimizing commutation antenna arrays in order to realize adaptive optimization procedures that work without any a priori information on the number and coordinates of interference sources. It is pointed out that the use of

digital processors in combination with a commutation antenna array enables realization of a fairly broad range of adaptive algorithms, each of which is ideally suited to solution of a specific problem, or even to a particular stage of a problem. For this reason, the effectiveness of a number of adaptive procedures is considered, each of which can be used either independently or in combination with others, forming a certain class of algorithms of adaptation of commutation arrays. The criterion of optimality is minimization of interference power with discrete phase distribution at the output of the array when the spatial position and intensity of the interference are not known, assuming fixed losses and efficiency. The given algorithms are multiple-step processes of permutation (search and arrangement) of the limited number of phase shifts in the elements of the array through a discrete control angle. The analysis is based on a synthetic Markov model and direct modeling. Figures 4, references 16: 13 Russian; 3 Western.

USSR

UDC 621.396.677.012.6

GENERAL REPRESENTATION OF STATISTICAL MOMENTS OF THE POWER RADIATION PATTERN OF A PARTLY COHERENT ANTENNA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1080-1083 manuscript received 3 Aug 76

VAGAPOV, A. M.

[Abstract] The statistical characteristics of the amplitude and phase radiation patterns of a partly coherent antenna can be directly expressed in terms of some set of the statistical characteristics of its complex radiation pattern $f = x + iy$. In this paper the author gives a general representation of arbitrary initial P^N and central ΔP^N statistical moments of the power radiation pattern of a partly coherent antenna in terms of the average value $\bar{f}$ and the mixed central moments $M_{mn} = \Delta f^{*m} \Delta f^n$, $\Delta f = f - \bar{f}$ of the complex radiation pattern f and the conjugate complex radiation pattern $f^* = x - iy$. The scalar problem is considered, i.e., all characteristics are determined for some fixed polarization component of the field of the antenna. References: 6 Russian.

USSR UDC 621.396.677.71

INVESTIGATION OF ELECTRODYNAMIC CHARACTERISTICS OF A RESONATOR-SLOT RADIATOR WITH SOURCES OF EXCITATION IN THE PLANE OF THE SLOT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 922-930
manuscript received 7 May 76, after revision 6 Sep 77

IL'INSKIY, A. S., GRINEV, A. YU. and KOTOV, YU. V.

[Abstract] A rigorous met od is developed for solving an integral equation of the first kind for determining the amplitude-phase distribution and the input admittance of a slot antenna of rectangular shape excited at arbitrary points located in the plane of the slot. The proposed numerical method as developed for Algol-60 is illustrated by calculations of amplitude-phase distributions and admittance of a resonator-slot antenna as a function of the geometry of the slot and the cavity, the number and location of the points of excitation. Calculations of the frequency dependence of the voltage standing wave ratio for different slot widths show that the passband of the antenna increases with slot width reaching a value of the order of 12 percent for a level of vswr = 2 when the slot width is 1 percent of the wavelength. The proposed method gives an accuracy of 1 percent in admittance calculation if 20 points per wavelength are used. The computer time on the BESM-4 is 20 minutes for plotting one characteristic curve when 14 points per wavelength are used. The numerical analysis is confirmed by experimental data. Figures 6, references 8: 7 Russian; 1 Western.

USSR UDC 621.396.677.83.012.12.001.24:681.3

DIGITAL COMPUTER CALCULATION OF THE POLAR PATTERNS OF CURVED RADIATING SURFACES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1289-1293 manuscript received 20 Sep 76

BAKHVALOV, V. N., ZAMYATIN, V. I. and SUKHAREVSKIY, O. I.

[Abstract] An algorithm is proposed for the approximate calculation of an integral that describes the radiation pattern of curved surfaces to which the method of current analysis is applicable. The basic idea of the algorithm is to break up the region of integration into triangular elements with subsequent linear approximation of the functions in the integrand. A numerical example of digital computer calculation by the proposed algorithm is presented. The results show that the proposed technique is very effective for calculating the radiation patterns of antennas. Figures 4, references 7: Russian.

USSR

ADVANTAGES OF LOG-PERIODIC SHORTWAVE ANTENNAS

Moscow VESTNIK SVYAZI in Russian No 6, Jun 78 pp 35-36

PIYUK, L. A., chief engineer, Tadzhik Republic Radio Broadcasting and Communications Center

[Abstract] Because of the space requirements of rhombic antennas in organizing long-distance radio lines, the Tadzhik Republic Radio Broadcasting and Communications Center has been using log-periodic antennas for setting up new directional lines up to 3,000 km in length. Arrays with horizontal polarization are used, the dimensions being determined by the frequency band, while doubled arrays provide the required gain increase. The author gives the principles of calculating aperture angle, period, angles of inclination between the arrays and the earth, angle between arrays, lengths and spacing of elementary radiators, and length of the arrays, as well as the relations between them. The standing wave ratio is plotted versus frequency for matching the feeder to the antenna. Radiation patterns in the horizontal and vertical planes are given for different frequencies, showing that the angle of inclination of the beams is nearly independent of frequency. These antennas have high windage, and are fairly complicated to set up, but they take up little space, and provide stable operation over distances of 2,000-3,000 km. The down time for malfunction of these antennas is on a level with rhombic antennas. Figures 4.

CZECHOSLOVAKIA

AIRCRAFT AND SHIP ANTENNAS FOR SATELLITE COMMUNICATIONS

Prague SDELOVACI TECHNIKA in Czech Vol 26 No 3, Mar 78 pp 89-91

KOLMACKA, FRANTISEK, Engineer

[Abstract] Antennas used for satellite communications must comply with specific design characteristics. The first requirement is the ability of the antenna to follow the satellite, whether the antenna is located on a moving communication center or is stationary on the earth's surface. Further, the antennas must have circular polarization when stationary; on board ship or on a plane linear polarization is acceptable. The total upper hemisphere must be covered by the antenna even in cases where the rotation along a given axis is 30°. On aircraft the antenna must not only possess limited air resistance, it must be light and have limited overall dimensions. On board ship the antennas should be based on a parabolic mirror and be designed for constant following of the satellite. To compensate for the movements of the ship a Cardan's suspension is recommended. The temperature range for satisfactory operation should be -65° to +95°C. Operational frequencies should lie between 100 and 2000 MHz. For low frequencies a single direction radiation characteristic is desirable and it should cover a wide zone. For higher frequencies plane phase series with high directional characteristics and a limited width of the beam can be used in combination with equipment designed for following the target. Figures 4; references 5: 2 Czech; 3 Western.

USSR

UDC 681.327.2

DESIGN OF MAGNETORESISTIVE DATA READOUT MICROSENSORS FOR BUBBLE DOMAIN MEMORIES

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 3, 1978 pp 17-22
manuscript received 30 May 77

KRASOVSKIY, V. YE. and RAYEV, V. K., Moscow

[Abstract] Analytical relations are considered for calculating the geometric parameters of magnetoresistive thick-film (0.3-0.5 μm) microsensors for data readout in magnetic bubble domain field access devices. The sensors are comprised of a number of V-shaped elements joined in series. The analysis is done for an isolated "V" with consideration of the fact that the output signal of a multiple-element sensor is proportional to the number of elements. Formulas are given for the average magnetization of the element because of the domain and controlling fields in terms of the saturation magnetization of the material containing the bubble domain, the thickness of this material, the gap between the V-shaped element and the domain material, the width of the element, the area of the element, the area of domain coverage, the length of a side of the element, the angle of turn of the control field, the vertex angle of the V, and the thickness of the element. Expressions are also given for calculating the output signal level of the sensor. It is shown that a cylindrical bubble domain magnetizes an element of the microsensor most effectively when the bubble is at one of the ends of the V. Curves are given showing the output signal level as a function of the length, width, thickness and vertex angle of a sensor element, and also as a function of the intensity of the control field. The results show that the output level increases with an increase in the length and a reduction in the width and thickness of the element, and with an increase in control field strength and vertex angle. The results of the proposed technique agree well with experimental data. Figures 3; references 5: 3 Russian; 2 Western.

USSR UDC 681.335

A HIGH-SPEED PULSE-TIME RATIONAL-FRACTION APPROXIMATOR BASED ON CURRENT SWITCHES

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 4, 1978 pp 69-73
manuscript received 21 Apr 77

MURSAYEV, A. KH., RYTEL', T. R. and UGRYUMOV, YE. P., Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin)

[Abstract] A considerable number of elementary functions can be represented by an approximation of the form

$$F(x) \approx \frac{\pm a_2 x^2 \pm a_1 x \pm a_0}{\pm b_2 x^2 \pm b_1 x \pm b_0} .$$

In this paper a universal second-order rational-fraction approximator is proposed that fixes the signs of the coefficients, giving an output voltage of the form

$$U_{out} = U_0 \frac{-y_1\theta^2 + y_2\theta - y_3}{y_4\theta^2 - y_5\theta + y_6} ,$$

where the Y_i are the conductivities of fixed resistors, θ is the relative duration of periodic duration-modulated pulses ($\theta = \tau/T$) of duration τ and frequency $1/T$, being proportional to the argument of the function, $\theta \in [0, 1]$. In addition to fixed resistors, the approximator contains a multiplier, a divider, opamps, and switches that can be set for realizing different signs of the coefficients in the elementary function to be approximated. The speed of the device is considerably increased by using commutating elements in the form of current switches instead of the conventional potential switches. This expands the input signal spectrum of these pulse-time computing devices by three orders of magnitude. Expressions are derived for the stability conditions of the device. Experimental models were made for approximating sine and tangent functions. The instrumental error at a commutation frequency of 1 MHz is no more than 0.3 percent for either instrument. With increasing commutation frequency, the error increases, and at 5 MHz it is 2.5 percent. Response time does not exceed 200 μs. The paper was recommended by the Department of Computing Technics. Figures 4; references: 4 Russian.

GDR

INFLUENCING VALUES FOR THE OPTIMIZATION OF THE MAJOR DIMENSIONS OF SINGLE-LAYER PRINTED CIRCUIT BOARDS

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 84-85

LEFFLER, D., Chamber of Technology, Erfurt

[Abstract] Selected influencing values for optimizing the dimensions are briefly discussed. They are derived from the individual and total component surface, number of components, average number of connections of the component types, number of soldered joints, packing-density factor and the length-to-width ratio of the board. The influencing values are partly design factors and partly manufacturing factors. Among the design factors are the number of comparable functional groups per circuit board, the number of comparable functional groups per product, the number of circuit boards per product, the manufacturing techniques and the designing techniques used. Formulas may be derived for establishing the optimum overall dimensions, which also consider the fact that the individual functional groups are often coupled through feedback, so that there are limits for possible development parallelisms. Overall, the total time required for designing and producing the printed circuit boards per product increases with the number of functional groups and with increasing circuit-board size, the absolute number of circuit boards decreases with increasing circuit-board surface. The relationships concerned permit a computer-aided optimization of circuit-board dimensions, and minimization of the costs of circuit-board design and manufacture, so that ultimately the design and manufacturing processes can be rationalized. Figures 1; references: 8 German.

GDR

COMPUTER-AIDED LAYOUT OF CIRCUIT BOARDS EQUIPPED PRIMARILY WITH DISCRETE COMPONENTS

East Berlin FERMELDETECHNIK in German Vol 18 No 3, 1978 pp 86-87

BURKHARDT, W., and ESCHKE, W., Chamber of Technology, Ilmenau; Ilmenau Technical College, Information Technology and Theoretical Electronic Technology Section

[Abstract] In order to ensure the required crossing freedom in the orthogonal and diagonal grid, the connecting pins fixed in the grid with their coordinates are assigned to the connection trees (potentials) as nodal points. It is assumed that on the average the expanse of a connection tree is in proportion to the number of nodal points. The smallest connection trees must

first be realized as tracings because each connection tree in its totality appears as an obstacle for the subsequent potential trees. Short connections have priority over long connections in order to ensure that the length is minimized in terms of all connections and detours. To create comparable lengths of connections before the realization of the connection trees as a layout and also to obtain an additional sorting criterion, the potential trees are developed into minimum trees. Because the minimum trees, as subgraphs of the circuit graph, are not connected to the grid through means other than their nodal points, there are numerous crossings of the minimum trees. Various methods may be used to eliminate the crossings on the basis of a crossings analysis. Only the minimum changes needed are made in the minimum trees in this process. The shortest crossing-free version is selected with the aid of computers. Figures 5; references 9: 4 German; 1 Russian; 4 Western.

GDR

DESIGNING PRINTED CIRCUITS AND MECHANICAL-DYNAMIC STRENGTH

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 87-88

LINDNER, H., Chamber of Technology, Leipzig

[Abstract] The author explains the significance of mechanical-dynamic strength in the design of the printed circuits of communications-electronic subassemblies, the selection of the design parameters on the basis of mechanical-dynamic strength (incorporation of the problems of mechanical strength in the task of the designer, method of calculation for the estimation of the mechanical-dynamic strength of a printed circuit board), the determination of the required design parameters for the most impact-resistant mounting of modular circuit boards (structure of a modular circuit board, determination of the required number of solder-joint pins and support panels for a given mechanical-dynamic exposure), and the advantages of the method of designing on the basis of the above information. The mechanical-dynamic strength of printed circuit board structures may be estimated in advance from the available structural parameters. The stressed cross sections may be optimized. This reduces to a minimum the required testing time and effort, ensures an optimum device quality, shortens the manufacturing process, and reduces the amount of modifications needed in the design process. Because it is difficult, and sometimes impossible, to establish by direct measurements the vibration and impact resistance of printed circuit board components and assemblies, it is highly desirable to calculate these data in advance so that optimization can be performed in the course of the designing process. Figure 1; references: 4 German.

GDR

AUTOMATED DIGITAL ACQUISITION OF GRAPHIC INFORMATION FROM MULTICOLORED DESIGN SKETCHES OF CIRCUIT BOARDS

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 89-90

STREUBEL, R., Information Technology Section, Area: Design and Technology, Karl-Marx-Stadt

[Abstract] A method is described for the digital evaluation of graphic sketches and their digital conversion into design aids. It is suitable for sketches with a maximum format of 800 by 1000 mm, made on smooth white paper with low-contrast grid with a 2.5 mm grid size, coding of various solder-lug diameters and conductor-strip widths by colored India-ink or felt pens in 0.5 mm and 2 mm increments, respectively, containing no alphanumeric characters, no kinks, and no branching points outside the grid. The sketches may be hand-drawn and be of any desired degree of complexity. The hardware involved in the process comprises a scanning head, a positioning system, a movement control system, an image-evaluation unit, and an image memory. The setup is illustrated with block diagrams and a photograph. The principal unit is the scanning head; it performs the photoelectric conversion and color interpretation. It features a rotating diaphragm disk on the Nipkov principle. Optimization has been achieved between the maximum number of recognizable colors and permissible color deviations in the individual colors that may be used in the sketches. The principle may be extended for the recording and evaluation of other graphic information for design purposes. Figures 4; references 4: 1 Russian; 3 German.

GDR

PROBLEM-SOLVING ALGORITHM FOR THE MINIMIZATION OF INTERSECTION POINTS AND LAYOUT IN THE ENGINEERING DESIGN OF PRINTED CIRCUIT BOARDS

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 91-92

SOMMERFELD, ERDMUTE, Central Institute of Cybernetics and Information Processes, Academy of Sciences of the German Democratic Republic, East Berlin

[Abstract] The algorithm described: 1) analyzes a given circuit on the basis of the principle of intersection-point minimization; 2) combines the logical components in a circuit into subassemblies (integrated circuits); and 3) assigns the integrated circuits to specific locations on a circuit board. The algorithm is a compromise between the sometimes conflicting criteria for problem structure, method of solution, quality of the solution, and

optimization when handled on the basis of engineering and purely mathematical considerations. For the control of the operator application (for maximum solution quality), the use of global information about state parameters. Problem categories are established for optimum separation of the components of the circuit with the aid of elementary operators, controlled by local and global information. The methods established for well and poorly structured separations are also realized with the aid of elementary operators on the basis of simulations with a NESM-6 computer. The computer program requires less than 5 seconds for the processing of a unit comprising 70 elements or for laying out these elements. Ninety-seven percent of all conduits were laid out automatically in experiments conducted at the Institute of Communications Engineering in Berlin, thus demonstrating the value of the algorithm. Figure 1; references 11: 3 Russian; 3 German; 5 Western.

GDR

MICROPROCESSORS AND MICROCOMPUTERS. PART 3

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 99-102

ZAREMBA, J., Chamber of Technology, Electronics Sections, Humboldt University, East Berlin

[Abstract] This part of the series of articles presents additional examples illustrating the problems of subprogram engineering. Initially, the previously prepared program is used for the summation of a finite number sequence for expanded tasks. One example requires the establishment of a special arithmetic mean value with a subprogram developed for this purpose; another requires the establishment of a subprogram for a 3-byte addition operation. The procedures for completing these tasks are described and three practising problems are posed to the reader in order to check his comprehension of the procedures and his proficiency in using them. (The solutions of the problems are not given.) The series will be continued. Figures 3; tables 3.

GDR

COMPUTER-AIDED PRODUCTION CONTROL WITH REAL-TIME PROCESSING

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 103-105

LISKOWSKY, R., Radeberg

[Abstract] The reasons why a transition was made from batch processing to real-time processing at the Robotron Electronics State Enterprise in Radeberg are described, and the hardware employed in the real-time system is briefly illustrated. The basis of the hardware system is an ES 1040 large computer. The "Project of Data Acquisition, Accounting, and Information System for Material Economy in On-Line Operation" (DEBAMO) was described in RECHENTECHNIK/DATENVERARBEITUNG Vol 14 No 11, 1977 pp 20-25. It has two terminals for goods receipt, one terminal for receipt control, and five terminals for material assignment. Problem programs are established for ordering and supply, material-receipt control, warehousing, and status queries and answers. The system provides advantages in terms of more efficient operation in the plant, more efficient handling of customer orders, and increased capacity through better utilization of the production facilities. On the basis of the basic data already available for the operation it is possible to expand the real-time processing further, ultimately to enable status-interrogation dialogs, processing of the basic data (parts, lists, production schedules, work-station data may be compiled), and status reports for ongoing production sequences. The real-time processing system is implemented on a gradual basis and should be expanded on the same basis. Figures 2; references: 5 German.

GDR

MICROCOMPUTER TECHNOLOGY. PART 10

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 27 No 5, 1978 pp 299-302

SCHLECHTER, JUERGEN, graduate engineer, and LINDNER, STEFAN, Dr of engineering

[Abstract] This part of the series discusses the following subjects: Selected control complexes in microprocessors and their utilization; clock-pulse control of the microprocessor; data input and output processes with and without ready/hold control; interrupt processing (vectorial interrupt marking, masked interrupt, interrupt with priority control); circuit in the tristable state; the memory unit of a microcomputer (organization of the working memory, memory capacity, recall spectrum, access time, cycle time, and fixed-value memory). The degree of equipment of a microprocessor with internal registers contributes to the determination of the computer performance.

Whereas a minimum set of registers is indispensable for the operation of the microprocessor, a more extensive set of registers allows more effective programming and provides time advantages because the internally available memory capacity reduces the number of the RAM accesses. The operating velocity of the microprocessor is thus also a function of the number of registers. The series will be continued. Figures 7; tables 1; references 5: 3 German, 2 Western.

HPR

MAGNETIC BUBBLE MEMORIES

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 24 No 2, 1978 pp 85-92

TOLGYESI, LASZLO, graduate electrical engineer, development engineer, Auxiliary Systems Department, BHG [Beloiannisz Communications Engineering Factory] Development Institute

[Abstract] This paper is concerned with a summary of the theory, design, construction, operation, performance, and applications of magnetic bubble memories, prepared on the basis of the following articles that have been published in BELL LABORATORIES RECORD: "The Magnetic Bubble" by A. H. Bobeck (1970, No 6); "Garnets for Bubble Domain Devices" by H. J. Levinstein, J. W. Nielsen, and L. J. Varnerin (1973, No 7); and "Magnetic Bubble Devices Moving From Laboratory to Factory" by J. E. Geusic (1976, No 10). Figures 11; references: 3 Western.

PPR

USE OF A CONTROLLED MAGNETIC-DOMAIN LATTICE IN OPTOELECTRONIC DEVICES

Warsaw ELEKTRONIKA in Polish Vol 19 No 3, Mar 78 pp 108-114

MONOSOV, YA. A., NABOKIN, P. I. and TULAYKOVA, A. A.

[Abstract] Band and labyrinth types of magnetic domain structures with an antiparallel orientation of magnetic moments are considered here from the standpoint of application to optoelectronic devices. Change of symmetry is the fastest means of controlling such structures by means of a uniform magnetic field, a weak magnetic field applied parallel to the magnetic moments.

Other simple methods of control include changing the lattice constant and rotating the lattice. As a result of such changes, the intensity of all diffracted light beams also changes but their distribution does not. These techniques, with diffraction of linearly polarized light by a domain structure with a meander distribution of magnetic moments, can be used for modulation of light in multichannel optical waveguides and for construction of three-dimensional dynamic light modulators. One interesting application of these principles is an optomagnetic decoder which contains as the central functional element a magnetic crystal which converts electric signals to optical ones. It can operate on the basis of neuron logic, majority logic, threshold logic, or some other logic. A 10-level device for modulating bismuth is being developed at the Institute of Radio Electronics of the USSR Academy of Sciences. The performance of such magnetic domain structures is analyzed here on the basis of the plane-wave approximation without birefringence. Accordingly, their theoretical speed and diffraction efficiency are calculated, their quality is evaluated in terms of the ratio of practically discernable to theoretically possible distinct positions of a diffraction beam, and the magnitude of the control power is estimated. The main advantages of magnetic domain structures are the elasticity of parameter variation, a high diffraction efficiency in the case of this Faraday-effect crystals, a high level of control power, and low energy losses. Among their drawbacks is that the diffraction efficiency and, during a change of the lattice constant, the diffraction beam intensity, depend on the diffraction angle. Figures 6; references 28: 16 Russian; 12 Western.

USSR UDC 621.391.837

INFLUENCE THAT SCANNING NONUNIFORMITY HAS ON SIGNAL SHAPING IN A VIEWING SYSTEM WITH TRAVELING LASER BEAM

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 4, 1978 pp 99-103
manuscript received 17 May 77

KRATIROV, I. A. and SHISHAGIN, A. A., Leningrad Electrical Engineering Institute of Communications imeni Professor M. A. Bonch-Bruyevich

[Abstract] The use of lasers as light-intensifying sources in television systems of the traveling-beam type considerably extends the range of action. Image quality in such systems is noticeably influenced by fluctuations in the index of refraction of the atmosphere, errors in deflecting mechanisms, possible vibrations of the entire unit and other factors that contribute to irregularity in scanning of the object. An analysis is made of the influence that trembling of the scanning beam has on video signal quality in a traveling-beam television system with linear scanning. It is shown that as a result of scanning nonuniformity, each component of the spectrum of the video signal is phase-modulated, i.e., a partial spectrum is formed that can be easily found if one knows the law of variation of $\Delta x(t)$ -- the parameter that defines the deviation of the center of the incident spot at any instant away from the position that corresponds to uniform scanning of the spot along the x-axis at a fixed velocity. This quantity can then be used in the conventional theory of phase modulation to determine the spectrum. Then the partial spectra thus found can be combined to give the complete spectrum of the video signal. This paper was recommended by the Department of Electronics and Quantum Devices. Figures 3; references: 2 Russian.

USSR UDC 621.397.62:681.775.7]:535.241.13:534

OPTICAL DEVICE FOR TV SIGNAL REPRODUCTION ON A BASIS OF AN ACOUSTIC-OPTICAL DEFLECTOR

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, 78 pp 3-10

BENEDICHUK, I. V., OBOZNENKO, YU. L., SMIRNOV, YE. I. and CHIRKOV, L. YE., All-Union Scientific-Research Institute of Television and Radio Broadcasting; Kiev State University imeni T. G. Shevchenko

[Abstract] The paper considers a device for TV signal reproduction accomplished on the basis of a Bragg acousto-optical deflector. The optical scheme of the reproduction device, the electro-optical light modulator, the acousto-optical horizontal deflector, and the functional circuit of the reproduction device are illustrated and discussed. With respect to resolution and contrast

an experimental model of the device assured the required quality of image reproduction. The experimentally measured characteristics of the device, with abberations of the optical systems and nonuniformities of the photoelastic medium taken into consideration, coincides with theoretically calculated values and by and large conforms with TV standard requirements. It should be noted that the frequency-contrast characteristics of the device for TV signal reproduction can be improved because of further perfecting of optical systems which form the apertures of light rays and the use of large-magnitude slices of photoelastic materials. Figures 8; references 13: 10 Russian, 3 Western.

USSR UDC 681.782.473

OPTICAL-MECHANICAL SCANNER FOR OBSERVATION OF THE EARTH

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, 78 pp 17-21

SELIVANOV, A. S., CHEMODANOV, V. P., SUBOROV, B. A., NARAYEVA, M. K., SINEL'NIKOVA, I. F., BONDARENKO, R. S. and SEREGIN, V. I.

[Abstract] Multichannel scanning devices of low (MSU-M) and medium (MSU-S) resolution serve as the principal sources of information for the television complex of the experimental earth satellites of "Meteor" Type (now called "Meteor-Priroda"), which are primarily intended for observation of the earth's surface. They transmit images in the visible and near-IR zone of the spectrum with a resolution on the surface on the order of a kilometer (MSU-M) and 100 meters (MSU-S). The equipment of the first two earth satellites of this series was designed for a rated height of orbit of 950 km, which assured capture bands of approximately 3000 and 2000 km, respectively. The third earth satellite was ejected into a synchronous orbit with an average height of 650 km, which assured constant time conditions of observation because of the turning (precession) of the plane of the orbit, synchronous with the annual movement of the earth around the sun. In so doing the capture band on the surface was proportionally decreased. The present paper is concerned with the principles of action and the basic parameters of the MSU-M and MSU-S. The optical scheme, the cinematic scheme, the electronic part of the MSU-M and MSU-S, and the structure are described. Photographs of the two units are shown. Figures 13; tables 2; references: 3 Russian.

CZECHOSLOVAKIA

POSPISIL, BOHUSLAV, Engineer

THE NEW SECAM/PAL DECODER DESIGNED FOR FUTURE PRODUCTION OF TESLA ORAVA COLOR TELEVISION RECEIVERS

Prague SDELOVACI TECHNIKA in Czech Vol 26 No 4, Apr 78 pp 151-153

[Abstract] The receivers will be provided with automatic switching systems in order to use the signal produced by the SECAM and PAL signal generators. The differential identification signal SECAM is transmitted during the period of the picture darkening impulse. The switching circuits resolve this signal from the overall TV signal; the separated resolved signal is detected and amplified. The circuit used is the A220D circuit, similar to the East German circuit TBA120S. The recovered switching current is entered as the feed voltage into the integrated circuit MBA540, and from there to outlet 4MCA640. The switching voltage in receiving the SECAM signal is zero volts; in receiving the PAL signal it is +12V. Figures 7; references 3: 2 Czech; 1 Western.

USSR

HIGH PRECISION IN FREQUENCY MEASUREMENTS

Moscow VESTNIK SVYAZI in Russian No 6, Jun 78 pp 33-34

KUPRIYENKO, V. P., chief engineer, graduate student, All-Union Correspondence Institute of Electrical Engineering of Communications, and LUCHSHEV, V. A., senior electrician, Novosibirsk Zone Station for Checking Electronic Equipment (STRK)

[Abstract] The article describes a short-wave frequency measurement facility set up at the Novosibirsk Station for Checking Electrical Equipment, Ministry of Communications, USSR. This installation enables periodic monitoring of the frequency stability of shortwave radio transmitters operating from the middle of the MF band to the top of the HF band (1.5-25.5 MHz). The basic equipment includes an R-250M2 receiver, an electronic frequency meter and an R-376 unit for SSB reception. The secondary laboratory standard on 1 MHz is a Ch6-31 frequency synthesizer. The frequency standard can be corrected when measuring the frequency of precision transmitters like the RTA, RVM and so forth. The facility works on the principle of formation of a signal that is coherent with the received signal with subsequent measurement by a counting-type frequency meter. This technique improves interference immunity as compared with methods in which the signal is mixed into the measurement channel. The equipment is comprised of four modules: the receiver, the frequency conversion module, the reference frequency module and the frequency meter. Tuning to the transmitting station is accomplished by adjustment to give a stationary Lissajou figure on an oscilloscope screen. The adjustment procedure is described. The equipment uses printed circuit technology with silicon transistors and diodes. Measurements can be made by personnel with a minimum of training. Figures 3.

USSR

CONCERNING STANDARDS FOR THE FLOW OF MATERIALS AND SPARE PARTS IN RADIO ENTERPRISES

Moscow VESTNIK SVYAZI in Russian No 6, Jun 78 pp 42-43

SOKOLOV, A. L., laboratory chief, candidate in economic sciences, and BELOUSOVA, T. A., chief engineer, Scientific Research Institute of Radio (NIIR)

[Abstract] The Scientific-Research Institute of Radio and its Kuybyshev division have worked out average sector-wide standards for consumption of

vacuum tubes, semiconductor devices, spare parts and materials in the operation and maintenance of equipment in radio communications and broadcasting, television, UHF and VHF FM broadcasting, and wire broadcasting. Standards have been worked out for the first time for equipment consumption in satellite communications and line-of-sight relay lines. The initial base for the calculations was statistical data on experience in radio enterprises. Calculations are for 1000 hours of operation with the exception of radio relay lines, antenna-feeder structures in communications and radio broadcasting, and wire broadcasting lines, which are calculated on a yearly basis. The formulas for determining standard flows of parts and materials are averages weighted for the number of units of equipment in the enterprise and the annual workload of the equipment. Consideration is taken of the number of components in a unit of equipment, the service life of the components, and the number of enterprises served. The new standards should be conducive to improved efficiency in the use of material resources in the communications industry.

USSR UDC 621.37

CONCERNING CONSTRUCTION OF COMPENSATION DIAGRAMS OF PHASE FLUCTUATIONS INTRODUCED BY COMMUNICATION CABLE LINES

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 6, 1978 pp 875-878 manuscript received 2 Feb 77

BEAGON, V. S., ROMANYHEV, YU. N., Scientific-Research Radiophysics Institute

[Abstract] In order to construct the compensation diagram of phase fluctuations introduced by communication cable lines, repeated opposing transmission of signals through the cable and further unification of these signals in various combinations is ordinarily used. In so doing the following operations are realized: mixing of signals with isolation of sum and difference frequencies, as well as multiplication and division of signals with various coefficients. The frequencies of signals obtained as the results of these operations is presented. An expression is determined for the phase incursion of a signal in a coaxial cable, the interior and exterior conductors of which are similar and made of one material, at frequencies where the skin effect is strongly conveyed ($f \geq 100$ kHz). The author thanks N. M. Tseytlin for attention to the work and much advise, as well as A. A. Romanychev and A. I. Chikin for very helpful comments during discussions. Figures 2; references 12: 8 Russian; 4 Western.

USSR

STATE OF THE ART IN HERMETIC COMMUNICATION CABLES AND THE OUTLOOK FOR THEIR USE

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 77-80

PARFENOV, YU. A. and TSALIOVICH, A. B.

[Abstract] The second "Scientific-Technical Seminar on Hermetic Cables for Local Telephone Communication" held in Leningrad in June 1977 was organized jointly by the Leningrad branch of the Scientific-Research Institute of Communications and by the Scientific and Technical Society of Radio Engineering, Electronics and Communications imeni A. S. Popov. Reports were given on the latest cable sealing techniques with hydrophobic filler grades LZK-1 and MZK. Search for cost reductions and for new conductor as well as insulation materials, such as aluminum alloys and porour polyethylene, is currently underway. In the meantime, KSPPZ and TPEPZ cables for rural and urban telephone networks, manufactured at "Belarus'kabel'" and "Tashkentkabel'" plants are more reliable and larger in size. Reports were given on problems in cable production and installation as well as on testing hermetic cables versus testing nonhermetic ones in use. Also the economic feasibility of installing hermetic telephone cables for special purposes such as communication in mines was discussed. The third seminar is scheduled for 1979.

USSR

UDC 621.37/39

REQUIREMENTS CONCERNING RADIO RELAY LINES FOR INTRAREGIONAL AND RURAL TELEPHONE COMMUNICATION

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 1-4 manuscript received 6 Jan 78

KAMENSKIY, N. N., KALININ, V. A., and POBORCHIY, YE. D.

[Abstract] The ratio of telephone lines to telephone+television lines in intraregional communication networks has reached the 7:3 level, with 70-80 percent of all telephone lines being up to 200 km long and having a capacity of up to 300 channels. Of the telephone+television lines, on the other hand, 70 percent are up to 400 km long with a capacity of up to 600-900 telephone channels and one or two simplex television channels. Thousands of new transmission systems are required for reconstruction and further development of intraregional communication networks. The choice between cable and radio systems will be determined essentially on the basis of cost factors, where the price of copper and the quality of service play important roles, but also

how fast either one can be installed. The same general criteria apply to rural communication networks. An analysis of three available radio relay systems "Kurs-2", "Kurs-8", and "Oblast'-1" indicates that, while the first two are inferior to their cable analogs with respect to cost per channel-kilometer, the third one is very competitive and may become more widespread. Figures 3; tables 1; references: 1 Russian.

PPR

UDC 621.39.001

STEPWISE EXPANSION OF A TELECOMMUNICATION NETWORK

Warsaw ARCHIWUM ELEKTROTECHNIKI in Polish Vol 25 No 4, Oct-Dec 78 pp 813-824
manuscript received 10 Jan 77

KOODZIEJ, WOJCIECH, Department of Automation, Warsaw Polytechnic Institute, STACHOWIAK, TADEUSZ and STANCZAK, WIESAW, Institute of Basic Information Theory, Polish Academy of Sciences

[Abstract] Stepwise expansion of a telecommunication network which generally consists of switching stations and transmission lines is analyzed here as a problem of investment planning. The development process is, as usual, confined to a time schedule which typically may extend 5 years. Funding is not subject here to any particular constraints except that it can be made available at the beginning of a year only. Furthermore, each investment is assumed to pay off after the same number of years. On the basis of these premises, a mathematical model is then constructed. With the target function properly defined, solution of this problem for any arbitrary branch characterized by a set of time segments and a set of discretization levels reduces to a search for a way to increase the capacity which will satisfy the demand and, at the same time, to minimize the quality indicator. The algorithm of dynamic programming, based on the Bellman theorem, involves a recurrence relation and is proved by finite induction to be more efficient than the algorithm of total search. It has already been written in FORTRAN 1900 for the ODRA 1325 computer, subject to further refinements. The authors thank Prof Dr Engr Hab Tadeusz Nowicki for the inspiration and scientific support, Prof Dr Engr Wojciech Oszywa for the review and useful comments, as well as the staff of the Department of Networks at the Institute of Communications for the criticism and practical suggestions. Figures 1; references 10: 2 Polish; 1 Russian; 7 Western.

USSR

UDC 621.327.8

TECHNICAL PROGRESS IN THE FIELD OF DATA TRANSMISSION

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 10-19 manuscript received 23 Mar 78

SHVARTSMAN, V. O.

[Abstract] Problems are discussed relating to the design of data transmission networks (SPD's) to be incorporated in the OGSPD [State-Wide System of Data Transmission]. SPD's are being developed along the line of creating isolated multiple-user SPD's and will be incorporated as subsystems in computer networks. Both communications organizations and computer technologists are participating in this development. Switching and channel equipment will be readily adaptable to conversion for digital methods of telephone information transmission in order to enable the creation in the future of integrated communications networks. For the time being general-use telephone networks and separate SPD's will coexist, the latter being created to take into account the specific requirements of their users. These requirements are analyzed in detail and distinguished from those of telephone network users. Multiple-user SPD's are being created to make the most efficient use of communication channels, the most expensive component. Foreseen beyond the stage of multiple-user computer networks is the creation of scattered computer networks incorporating SPD's and computer facilities into a single unit, thus resulting in an enormous expansion of computing and information capabilities. An analysis is given of key problems in the creation of SPD's. Steps in the design procedure are outlined, with emphasis on the switching method, as the most critical choice materially influencing the list of services rendered by the network. Channel switching, message switching and package switching, as well as combinations of these methods, are discussed in detail, in terms of relative advantages and disadvantages. No one method of switching fully satisfies all requirements. Combined utilization of package switching and formation of a virtual channel are also treated. The flexibility and simplicity of the channel switching method in terms of transmission rates, codes and methods is keynoted. Aspects of data transmission specific to applications in computer networks are discussed, such as the sequence for establishing connections between several users in the time-sharing mode. The package-switching, virtual-channel design is employed for exchange of information between computers. The merging of SPD's and computer hardware in modern microminiaturized systems is discussed, with emphasis on the distribution of roles between computer technologists and communications specialists in the development of equipment. SPD equipment is discussed in terms of key questions such as its adaptability to future requirements and the employment of the multiprocessor modular principle in the design of switching equipment. Compatibility for the transmission of data and telephone signals will yield maximum savings for transmission over long distances; therefore, integration in this area is considered the most intelligent approach for long-term development. Figures 4.

USSR UDC 621.372.6.001.5

WAVE MATRICES OF LOADED MULTITERMINAL NETWORKS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1015-1021 manuscript received 23 Feb 76

ONISHCHUK, A. G.

[Abstract] A technique is proposed for determining the wave scattering matrices of loaded multiterminal networks which completely describes the properties of an arbitrary linear system for signal transmission in the microwave band. In the general case, the signal transmission system is made up of a block of interconnected oscillators, a block of interconnected loads, and an arbitrary paired-terminal network in which the number of terminal pairs equals the number of oscillators and loads combined. The solution is based on structural peculiarities of the scattering matrices of multiterminal networks according to which a dissipative 2n-terminal network is represented as the equivalent nookup of a matched and decoupled 2n-terminal network and a nondissipative 2n x 2-terminal network. The derived formulas are applied to the specific case of a microwave signal transmission system made up of a four-terminal network and two-terminal oscillator and load. The resultant scattering matrix of the loaded four-terminal network completely describes the properties of a microwave amplifier with arbitrary boundary conditions. Figures 4; references 11: 7 Russian; 4 Western.

USSR UDC 621.391

NOISE IMMUNITY OF AN ADAPTIVE RADIO COMMUNICATION LINE OPERATING AT SUBEXTREMAL FREQUENCIES

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 80-81 manuscript received 18 Apr 77

ALIMOV, V. A., BURTSEV, S. T. and RAKHLIN, A. V.

[Abstract] The noise immunity of a radio communication line operating at frequencies subextremal with respect to the signal-to-noise ratio is analyzed by calculating the mean probabilistic error of transmission in a binary modem channel with Rayleigh signal attenuation and a log normal noise distribution. The energy payoff of adaptation is determined on this basis and compared with that of adaptation at extremal frequencies. The results indicate a higher noise immunity of channels with adaptation for fadeout of short-wave signals, but a lower energy payoff than with adaptation for noise of appreciable band nonuniformity. Figures 2; references: 6 Russian.

USSR UDC 621.391.2

ON THE STABILITY OF A NONPARAMETRIC TEST IN INCOHERENT PROCESSING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1164-1173 manuscript received 21 Mar 77

AKIMOV, P. S., YEFREMOV, V. S. and KUBASOV, A. N.

[Abstract] The authors consider the problem of synthesizing an optimum device for detecting a signal against interference based on the theory of testing statistical hypotheses. Analysis of the quality of nonparametric tests shows that they are nearly as effective as the optimum classical method for maintaining constant probability of false detection. When there is a change in the distribution function of the interference, rank algorithms may be considerably more effective than the classical optimum test, which is applicable only to normal interference. The characteristics of a von Neumann-Pearson rank detector are compared with those of classical incoherent detectors for different kinds of interference distribution. The rank detector is based on a statistic that uses the sum of the ranks of readouts of the envelope of the signal sample relative to readings of the interference sample. A measure of stability is proposed that is based on the ability of an algorithm to maintain its characteristics within certain limits, or to improve its characteristics when there is a change in the interference situation using the Bayes risk as the decision making rule. The criterion of equal power is taken as the test of identification of distribution functions that form a class of hypotheses. Wybull, Rayleigh, exponential, gamma, logarithmically normal, Nakagami and inverse distribution laws are considered. Expressions are given for defining alternative distributions. The results show that rank detectors are more stable in the face of a change in the interference environment (in the sense of maintaining or improving their characteristics) than is the classical incoherent detector. In addition to its effectiveness, the adaptive detector is comparatively simple in design. It should be possible to develop such a rank detector that calculates the likelihood ratio on the basis of Weybull distribution, the expected value of the signal amplitude, and the measurement result of two moments of distribution of interference. Figures 6; tables 1; references 12: 10 Russian; 2 Western.

USSR UDC 621.391.2

ON CALCULATING THE EFFICIENCY OF SEQUENTIAL QUANTIZED SIGNAL DETECTORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1085-1088 manuscript received 9 Aug 76

GEN, YE. M. and TOLCHINSKIY, G. YE.

[Abstract] A method is proposed for exact calculation of the characteristics of sequential quantized signal detectors consisting of a binary quantizer and an accumulator for the case of a signal which appears at an unknown time, and the efficiency of such detectors is investigated. The measure of efficiency is the average time of detection for a fixed average interval between false alarms. Curves for the average time of detection τ as a function of the threshold of detection B have a minimum that shifts toward lower B with increasing signal-to-noise ratio q. At sufficiently high q, the function $\tau(B)$ becomes non-decreasing, so that the minimum average time of detection is reached when $B = d + 1$, where d is a constant integer that characterizes the rate of accumulation. In this case, the sequential quantized signal detector becomes a logical detector according to the criterion "1 out of n." Calculations show that this detection criterion ensures the minimum average detection time for the given class of detectors in the case where the signal energy can be sampled in a single observation with fixed energy expenditures per unit of time. Figures 2; references: 7 Russian.

USSR UDC 621.391.2

ON THE RELATION BETWEEN THE LIKELIHOOD RATIO AND THE A POSTERIORI CHARACTERISTICS OF RANDOM SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22 No 5, May 78 pp 967-973 manuscript received 15 Apr 77

SHMELEV, A. V.

[Abstract] An investigation is made of the relation between the likelihood ratio and the a posteriori characteristics of random processes in fields that are received against a background of Gaussian noise. Formulas are derived for using the known likelihood ratio to calculate not only the average values, but also any a posteriori multiple-point interpolation cumulants and moments of the useful space-time signal. For purposes of generality, the signal and noise are assumed to fluctuate in both time and space. In addition, an examination is made of the inverse problem of expressing the likelihood ratio in terms of the average a posteriori estimates of the

useful signal. This problem has been dealt with previously for the case of white Gaussian noise in the received signal. Now a space-time analog is found for the previously derived expression for the likelihood ratio, assuming that the noise is white in time, but may be correlated in space. An investigation is also made of the influence that time correlation of noise has on the structure of an optimum detector. References 6: 2 Russian; 4 Western.

USSR UDC 621.391.2

OPTIMIZATION OF A MULTIPLE-SECTION LINEAR FILTER WHEN NOISE ACTS ON THE INPUTS OF THE SECTIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 984-992
manuscript received 11 Sep 75; after revision 4 Apr 77

POLYAK, B. I.

[Abstract] An examination is made of the problem of determining the optimum characteristics of the individual sections of a multiple-element linear detection system (multiple-section filter) for known spectra of the signal and noise at the input of each section. Relations are derived for the optimum transfer functions of the filter sections, taking the signal-to-noise ratio as the optimality criterion. This parameter is an exhaustive characteristic of optimality of such systems, and in the case of Gaussian noises, it defines the probability characteristics of detection. It is shown that the signal-to-noise ratio reaches a maximum at a certain optimum value of the passband of a multiple-section filter. The results can be used in synthesizing system for transmitting and extracting information. Figures 8; references: 9 Russian.

USSR UDC 621.391.2

ON THE THEORY OF ADAPTIVE RECEPTION OVER PARALLEL CHANNELS UNDER CONDITIONS OF ACTION OF LUMPED INTERFERENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 993-1000
manuscript received 15 Feb 77

FAL'KO, A. I.

[Abstract] An examination is made of adaptive signal reception over parallel channels in the case of incomplete signal separation against a background of spectrally lumped interference and random noise. It is assumed that the lumped interference spectra do not overlap. Adaptive reception algorithms are presented that depend on matrices that characterize the degree of separability of the signals and the mutual correlation of signals and lumped interference in different reception channels. Analysis shows that reception over parallel channels with strong mutual correlation may not be very effective even with complete separation of signals. This may be the situation for instance in space diversity reception, and in this sense it is more effective to use frequency diversity reception. In cases where complete separation of signals is made more difficult by the presence of lumped interference, special kinds of signals can be used to overcome these difficulties, e.g., signals of the frequency-time matrix type, noise-like signals and so on. The reception algorithm is considerably simplified where the signals are completely separable and there is no mutual correlation between the signals and lumped interference in the different channels. References: 5 Russian.

USSR UDC 621.391.2

SYNTHESIS OF COMPOSITE LINEAR FREQUENCY SEQUENCES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 948-956
manuscript received 14 Apr 77

GONTARENKO, V. P., KOSHEVOY, V. M., STRUCHEV, V. F. and CHEKUROV, G. I.

[Abstract] Two approaches are considered for synthesis of composite linear frequency sequences. The first involves synthesis of optimum sequences with consideration of required limitations on the uncertainty function and signal parameters, and does not guarantee whole-number values of the resultant frequency codes, while the second approach is based on selecting a signal frequency code using linear recurrent sequences. This approach not only guarantees whole-number code values, but in some instances enables realization of uncertainty function parameters that are close to optimum as well.

It is shown that the maximum side lobe of the uncertainty function in the "free" region can practically be reduced to its minimal value. Figures 3; references: 5 Russian.

USSR UDC 621.391.2

ANALYSIS OF A METHOD OF ACCELERATING LOCK-IN OF A CORRELATION RECEPTION SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 957-962
manuscript received 5 Jul 76

KLYUYEV, L. L.

[Abstract] The author describes the working principle of a device of his own invention for finding a D-sequence [Soviet Patent No 438130 granted in 1974] that involves correlating an input D^n-sequence with period 2^n in a mod-2 adder with a periodically repeated segment of the same sequence with period 2^k (D^k-sequence), giving an output sequence with period 2^{n-k+1} and duration of the discrete $2^{k-1}\tau_i$, where τ_i is the duration of the discrete of the initial sequence. A disadvantage of this method is that a considerable part of the energy of the received signal is lost in the correlation process. It is shown that these losses can be eliminated by using a receiver that enlarges the discrete of the D-sequence. The proposed receiver is based on equations derived by V. I. Tikhonov and A. S. Stepanov [see "Radiotekhnika i elektronika," Vol 18, No 7, 1973 p 1376] for filtration of continuous and discrete parameters. It is shown that the use of such a receiver gives an appreciable gain in interference immunity and speed. Figures 3, references: 5 Russian.

USSR

UDC 621.391.2

VOLUME OF LARGE SYSTEMS OF DISCRETE FREQUENCY SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 963-966
manuscript received 29 Dec 76

VARAKIN, L. YE.

[Abstract] An analysis is made of the volume of large systems of discrete frequency signals, i.e., sequences of radio pulses emitted on different frequencies in accordance with a frequency keying law. The correlation functions of discrete frequency signals in the case of discrete time shifts are determined by the number of coincidences of the frequency elements (radio pulses on different frequencies) on the frequency-time plane. Optimum systems of this kind in which the number of coincidences between different pairs of signals for arbitrary time shifts is equal to 0 or 1 have a volume no greater than the number of frequency elements. However, technical applications call for systems with a volume equal to the square of the number of frequency elements. It is shown in this paper that the volume of large systems of discrete frequency signals increases as $(n + 1)!$, where n is the maximum number of coincidences of the frequency elements of the signals on the frequency-time plane. The volume of such large systems is practically independent of the number of frequency elements. References 7: 6 Russian; 1 Western.

USSR

UDC 621.391.2

INFLUENCE THAT THE MANY-ELECTRON COMPONENT OF PHOTOCURRENT PULSE AMPLITUDE DISTRIBUTION HAS ON INTERFERENCE IMMUNITY IN OPTICAL SIGNAL RECEPTION

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 3, 1978 pp 95-98
manuscript received 5 Apr 77

KLYUKIN, V. E., VIKTOROV, L. V. and SHUL'GIN, B. V., Ural Polytechnical Institute imeni S. M. Kirov

[Abstract] An investigation is made of the probability density function of filter output voltage with binary detection of an optical signal of given duration, with inclusion of a term that accounts for the many-electron component of the photocurrent pulses in the photomultiplier. Calculations of the probability of a false alarm for different average numbers of noise photoelectrons over the given signal duration are compared with and without consideration of the many-electron component. The results show that disregarding the many-electron component may result in considerable distortion of the probability of false alarm, especially when these probabilities are low. The paper was recommended by the Department of Experimental Physics. Figures 2; references: 5 Russian.

USSR UDC 621.391.2

RECOMMENDATIONS OF INTERNATIONAL CONSULTING COMMITTEE ON TELEGRAPHY AND TELEPHONY (MKKTT) REGARDING SPECIAL-PURPOSE DATA TRANSMISSION NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 74-80 manuscript received 2 Dec 77

YETRUKHIN, N. N. and OSIPOV, V. G.

[Abstract] A synopsis is given of Series X recommendations, relating to the design principles of so-called public data (DOP) networks specially created for data transmission, given by the Sixth Plenary Assembly of the MKKTT of MSE [International Telecommunication Union (Geneva)] in 1976. These recommendations give suggestions for various solutions to problems relating to interfacing, signaling, switching, multiplexing methods, and related topics. DOP networks will be created on the basis of special-purpose switching equipment with program control and of channel-forming systems with time-division multiplexing. These networks will be less expensive to operate than existing telephone and Telex switchable communications networks. The control principles employed in DOP networks are sufficiently flexible to allow for provision of new services unavailable today. A DOP network performs a considerably wider range of functions than existing networks, including the function of linking directly to data terminals (OOD's), and not through data transmission equipment (APD). Interfacing between OOD's and the line to the DOP network is entrusted to data channel terminals (AKD's), which belong to the communications administration, and not to the user. Summarized are the recommendations of MKKTT regarding the general characteristics of DOP networks, regarding interfacing between OOD's and AKD's, regarding start-stop OOD's, regarding channel-forming equipment, and regarding interfacing between national DOP networks. Series X recommendations are published in full in Volume VIII, Part 2, "Public Data Networks," of the "International Telecommunication Union Orange Book," Geneva, 1977. Figures 5; tables 5; references 2: 1 Russian; 1 Western.

USSR UDC 621.391.2.018.756

EIGENFUNCTION AND PROBABILITY DENSITY FUNCTION OF PULSE FLOW AT THE OUTPUT OF LINEAR SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 974-983 manuscript received 1 Mar 77

ANTONOV, O. YE., IL'CHENKO, YU. V. and PONKRATOV, V. S.

[Abstract] The authors consider the problem of determining the statistical characteristics of non-Gaussian random processes after passage through linear

inertial circuits. A general approach is proposed for solving the problem of finding the probability density function of a steady-state Poisson pulse process, based on a generating functional method that yields univariate and multivariate eigenfunctions of a random process at the output of a linear system when different flows of short pulses (not necessarily Poisson flows) act on the input. This technique also gives univariate and multivariate unsteady probability density functions, for instance those describing transient processes in filters. It is assumed that the duration of the input pulse is much shorter than the pulse characteristic of the linear system, enabling approximation of the input process by delta impulse functions, and approximation of the random output process by a sequence of pulse characteristics of the linear system. Univariate and bivariate probability density functions are derived for the process at the output of an integrating RC network for a steady-state flow. References 9: 7 Russian; 2 Western.

USSR UDC 621.391.2.029.7

INTERFERENCE IMMUNITY IN RECEPTION OF OPTICAL PULSE SIGNALS IN COMMUNICATION CHANNELS WITH SCATTERING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1298-1302 manuscript received 6 Sep 76

BORISOV, E. V. and KOVTUN, A. F.

[Abstract] Considerable spatial-angular and time redistribution of energy is observed when optical signals are received in communication channels with scattering. An analysis is made of the influence that the resultant distortions have on the interference immunity of signal reception. The model is based on an optical transmitter and receiver with given antenna aperture angles separated by a fixed distance with coincident optical axes. The emission of the transmitter is uniformly distributed throughout the solid angle of the antenna aperture. The scattering medium between the antennas is assumed to have plane-parallel boundaries and a known geometric thickness. The radius of the emission spot on the scattering medium is assumed to be no greater than the thickness of the medium. The optical characteristics of the scattering medium in the visible and near infrared spectral regions are assumed to correspond to those of a plane-parallel cloud layer. The probability density $J(x)$ is determined for the random quantity $x = (l - L)/r$, where l is the mean free path of a photon between the transmitter and receiver, L is the distance between antennas and r is the thickness of the scattering medium. It is shown that this distribution expands with an increase in the geometric and optical thickness of the scatterer. A formula is derived for the signal shape at the receiver input after passage through the channel with scattering, and numerical results are given for a square pulse

of 1 and 2 μs duration for different optical thicknesses when r = 300 m. These results show that signal distortion increases with a reduction in pulse duration. As the geometric and optical thicknesses of the scattering medium increase and the duration of the optical pulse decreases, the signal shape at the receiver input depends less and less on the shape of the transmitted pulse, and more and more on the optical-geometric parameters of the scattering medium. The given model is close to the actual situation of optical data transmission through a cloud layer, and shows that a scattering medium may have a very detrimental effect on the interference immunity of this kind of communication channel. Figures 9; references 7: 6 Russian; 1 Western.

USSR UDC 621.391.14

FREQUENCY-AND-SPACE MARGINS OF THE DECAMETER WAVE BAND

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 100-101 manuscript received after completion, 11 Jan 77

KOMAROVICH, V. F., VOLOSHIN, N. I. and FARBIROVICH, M. YA.

[Abstract] Frequency-time, frequency-energy, and frequency-space margins of the decameter wave band are determined by the statistical performance parameters of all radio stations throughout the world as well as by the randomness characterizing the far- and medium-range propagation of signals reflected by the ionosphere. Here the frequency-space margins are calculated, depending on the bandwidth and on the noise level. The latter in turn depends on the time, on the geographical location, and on the antenna design. Noise levels are averaged over N-dimensional random sequences and, on this basis, their correlation factor is calculated as a function of the distance between points. This function is nearly exponential, with an attenuation factor of 0.003/km within the 250-300 km range. Within distances shorter than 150 km there is a close statistical correlation between the averaged noise levels at two reception points, the correlation factor being equal to 0.65-0.75 during the night and 0.55-0.65 during the day. When the distance between points is greater than 350-500 km, there is hardly any correlation between the levels of random noise at the same reception frequency. These conclusions are based on measurements with a VG $\frac{2x20}{12}$ antenna, a passband of 1200 Hz, and a noise integration time of 1.5 s. The duration of each test, during the day and during the night, was 4 h. Figures 2; references: 4 Russian.

USSR UDC 621.391.15

PROMISONG METHODS OF NOISEPROOF CODING

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 70-73 manuscript received 3 Jul 77

BLOKH, E. L. and ZYABLOV, V. V.

[Abstract] A demonstration is given of the fact that, in spite of the many still unsolved problems in the area of distortion-correcting codes for communications systems, the level of development which has been reached makes it possible to meet the demands of the present and of the immediate future. Attention is paid in particular to step-by-step codes, which it is shown can be used in channels with both low and high noise intensity. The key requirements for noiseproof coding are detailed, breaking down the problem of the practical utilization of correcting codes into the three problems of specifying the code, or selecting the set of code words to be used for transmission, coding, or developing an algorithm and a coder to implement it, and decoding, or developing an algorithm for matching a word received with a code word and the decoder for implementing this algorithm. These three problems are analyzed in terms of relative complexity. Classes of codes are considered here for which, in selecting methods of code protection, the growth in complexity of all three problems is of a power-relationship nature. The fundamental problem of noiseproof coding is formulated as follows: For a given transmission rate and code length and with errors of known nature in the channel, it is necessary to achieve specified transmission fidelity with minimum expense for extra equipment, i.e., with a coder and decoder of minimal complexity. Only binary symmetric channels without a memory and with grouped errors, such as satellite channels and standard telephone and telegraph and shortwave radio channels, are discussed. Possible codes are analyzed with reference to the fundamental equation from coding theory, which proves that certain "good" codes exist for which the probability of erroneous detection, P_0, with long code lengths, n, will diminish exponentially, or:

$$P_0 \leq 2^{-nE(R, \varepsilon)},$$

where function $E(R, \varepsilon)$, independent of n, is called the error probability exponent. Codes are discussed which correct errors in channels without a memory, with low and high noise intensity, and in channels with a memory. It is demonstrated that step-by-step codes are the only codes known by means of which, in a channel without a memory with high noise intensity, it is possible to achieve a probability of error which diminishes in relation to n with a power-relationship growth in complexity of implementation. Unified step-by-step codes have realistic prospects for practical employment in channels with grouped errors. The flexibility of a step-by-step code with respect to the nature of errors which can be corrected is determined by the key property of step-by-step decoding, whereby internal codes accomplish the best matching of the auxiliary external channel with the external codes

which correct errors and erasures. Many long algebraic codes are promising for channels with low noise intensity. With the exception of step-by-step codes, only short codes can be used in channels with high noise intensity, because of the exponential complexity of implementation. References: 11 Russian.

USSR UDC 621.391.24

ENERGY SPECTRUM OF A RADIO SIGNAL IN A SYSTEM WITH MULTIVALUED FREQUENCY MANIPULATION

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 94-97 manuscript received after completion, 12 Apr 77

TERENT'YEV, L. V.

[Abstract] Multivalued frequency manipulation is more and more widely used for generating a radio signal in discrete systems. Such a signal, formed by a random process with a finite number of discrete values, can be made to appear at the encoder output as a function of time. All signal carriers are assumed to be harmonic oscillations of equal amplitudes but different frequencies and initial phases. An expression for the energy spectrum of such a signal is derived here by correlation analysis, first in the simplest case of m = 2 values. The results are then extended to any number m, and the energy spectra of the correlation functions are found to be always symmetrically bilateral with respect to the frequencies of the corresponding discrete signal components. Figures 1; references: 2 Russian.

USSR UDC 621.391.82

REJECTION OF COMPLEX OF LUMPED INTERFERENCE

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 3-9 manuscript received after completion, 3 May 77

GOL'DBERG, A. P.

[Abstract] The complex of interference lumped in time and frequency at the input of a receiver is analyzed here in terms of errors caused by signal processing over necessarily finite time and frequency intervals. The peculiar spectral-time characteristics and the rather high energy content of

lumped interference make it possible to reject such an interference complex prior to optimal signal filtration. This requires simultaneous and matched rejection along both the time axis and the frequency axis on the basis of Fourier and inverse Fourier transformations. An optimal system for this purpose must include a memory and a detector where nonlinear coupling between signal and interference is possible. A simpler suboptimal system includes a detector, a differentiator, a threshold device, a coincidence circuit, and a delay line. Figures 5; references: 8 Russian.

USSR UDC 621.391.154

NOISEPROOF CODES IN DATA TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 65-69 manuscript received 3 Nov 77

DMITRIYEV, O. F., PETROVSKIY, I. B. and POPOV, O. V.

[Abstract] A description is given of methods which make it possible, at relatively moderate expense, to take into account the influence of the code on the probability characteristics (VKh's) of a data transmission system (SPD). It is suggested that the utilization of these methods at the initial stage of designing an SPD will improve the effectiveness of the solutions adopted and the quality and economic ratings of the OGSPD [State-Wide System of Data Transmission]. Binary linear (n,k) codes are used chiefly in SPD's for protection from errors introduced by discrete channels (DK's), and they correct these errors either directly or in conjunction with feedback. Feedback is used at present in almost all the SPD's in the Soviet Union. The number of codes used to detect errors in existing SPD's is fairly extensive and will probably expand. An urgent problem is that of a substantiated choice of the type of code, its length, and redundancy. Consideration is given here to the problems which arise in selecting codes at the initial stage of development of an SPD and to ways of solving these problems. A brief description is given of codes used in existing SPD's, with emphasis on the two main types: cyclic and highly simple iterative, or matrix, codes. The choice is determined to a considerable extent by the simplicity of the hardware and software used for coding and decoding. In selecting the code, taken into account are both the complexity of implementing it and the probability characteristics which the SPD will have with this code and the algorithm specified. The key VKh's of an SPD are its speed and data transmission fidelity ratings, the latter ordinarily characterized by the probability of error in a word or character in a message in the output of the SPD. Difficulties in estimating the VKh's of an SPD at the development stage are associated with the contradictory requirements of ensuring sufficiently low redundancy in the code used for error detection, and

sufficiently low probability both of an undetected error and of erasing a word. An increase in redundancy and the probability of word erasure reduces the speed, and in the probability of an undetected error, the fidelity of data transmission. A sound choice of code is possible only on the basis of predicting the behavior of the SPD in which it is to be used, in contradistinction to the present trend of reducing the length of the code while deteriorating the quality of discrete channels. Methods of estimating the probability characteristics of a code are analyzed and a type of estimate is derived which takes into account fully the structure of the code and, to a considerably greater extent than other methods used, also takes into account the nature of errors in DK's. All other things being equal, the accuracy of this type of estimate is improved as the length of the code increases and its redundancy is reduced. Results are given of estimating the probability characteristics of codes used in YeS [unified system] computer transmitting equipment. Graphs are shown which illustrate the fact that the probability of undetected error in a block, character or symbol in the output of the SPD considered practically is determined by the code and the DK. Curves are given which can be used to select the optimal length of codes. The behavior of a DK is described by a cascade-type Markov model with a moderate number of switchable noise sources, whereby an estimate of the SPD's VKh's is obtained by weighting estimates obtained for each noise source individually. Figures 2; references 16: 15 Russian; 1 Western.

USSR UDC 621.394.44

'DUMKA' DUPLEX GENERAL-PURPOSE MULTIPLEXING CHANNEL-FORMING EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 55-60 manuscript received 7 Sep 77

GUROV, V. S., KOROL', V. I., MINKIN, E. B., USOV, I. S., TSIREL'SON, D. A. and YAROSLAVSKIY, L. I.

[Abstract] A description is given of the "Dumka" duplex general-purpose multiplexing channel-forming unit, which has passed in-plant and on-line tests and has been readied for series production. This unit, designed to improve the effectiveness of utilization of the frequency band of a telegraph frequency channel by forming a discrete channel with maximum carrying capacity which is then used for time-division multiplexing, is constructed with a series 155 integrated microcircuit as its main logical element and utilizes series 186 microcircuits and active RC networks employing integrated operational amplifiers designed from series 140 and 153 microcircuits. The "Dumka" consists of four main units: a multiplexer, a signal converter (modem), an error-protection unit, and a power pack. The "Dumka" is designed for secondary multiplexing of standard 4-wire telegraph cable

communication lines with a maximum line length of 6000 km and a maximum of 8 retransmission sections. The channels to be multiplexed must conform to the standards set for audiofrequency telegraph channels. The unit's group on-line transmission rate is 9600 bits per second with a relative variance no greater than $5 \cdot 10^{-5}$. The mean signal strength in the input of the telegraph channel (at zero relative level) does not exceed -13.04 dB, or 50 μW. The "Dumka" unit makes it possible to form 23 code-independent channels with a maximum transmission rate of 50 bauds, 4 code-independent channels with a maximum transmission rate of 200 bauds, or 45 code-dependent channels for sending start-stop signals in MTK-2 code at a rate of 50 bauds with 7.5 elements in a character. Two or 4 code-dependent 50-baud channels can be combined to form code-independent channels with a rate of 100 and 200 bauds, respectively, and 3 code-dependent channels can be combined to form one code-independent channel with a maximum transmission rate of 50 bauds. The level of isochronous distortion in code-independent channels does not exceed nine percent and is independent of variation in temperature, power, or component aging. The "Dumka" is powered from a 220 V + 10%, -15% AC line or a -60 V battery. Its power requirement from an AC line is 700 VA, and from a battery, -500 W. AC-DC switching is automatic. Maximum noise rejection at 9600 bits per second is achieved by utilizing a signal converter designed to transmit a total group signal by the 2-level amplitude and single-stage relative phase modulation method with a partially suppressed single sideband. Inter-character distortions are corrected by a two-stage system. Block diagrams and specifications are given for all units. The "Dumka" is designed as an equipment rack measuring 2600 x 600 x 225 mm. Figures 4; tables 2.

USSR UDC 621.394.44

WAYS OF IMPROVING CHANNEL-FORMING EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 40-45 manuscript received 20 Jul 77

VOL'FBEYN, S. P., KOROP, B. V., USOV, I. S. and SHTUL'MAN, A. I.

[Abstract] An increase in the number of discrete channels, necessitated by the development of the telegraph and data transmission networks, is being hampered by an insufficient number of telegraph frequency (TCh) channels. The discrete channel network must be expanded without an increase in servicing personnel, without taking up more space, and without increasing the capacity of systems powering communications centers. The solution to these problems lies in a drastic improvement in the quality ratings of channel-forming equipment. It is shown that it is possible to create general-purpose channel-forming equipment with time division of channels for transmission of discrete information through communications channels of different

types. The resulting system makes it possible to transmit both anisochronic start-stop and isochronic signals. A demonstration is given of the advantages of time division multiplexing over traditional systems. It has been shown that the effectiveness of utilizing the frequency band of a telegraph frequency channel increases approximately by a factor of 2.5 in transmitting anisochronic signals, resulting in the need for twofold fewer telegraph frequency channels to transmit a given amount of discrete information. The low power of the signal at the output of the modem (50 μW, maximum) makes it possible to assign almost any number of telegraph frequency channels for transmission of data and telegraph information at rates of up to 200 bauds. Employment of time division multiplexing will result in a reduction in cost per unit of range of communications of approximately by a factor of 1.2 to two, as compared with the cost of the TT-48 equipment used at the present time. Trends in the improvement of frequency division multiplexing and time division multiplexing equipment are noted and compared. Frequency division multiplexing equipment is currently the most widespread in the Soviet Union. Time division multiplexing equipment is discussed in relation to the development of pulse code and other digital communications systems, the creation of digital integrated microcircuits, and progress in the manufacture of high-efficiency modems for operation in broadband and telegraph channels. Tables 2; references: 11 Russian.

USSR UDC 621.394.44

FUNDAMENTALS OF THE DESIGN OF NEW AUDIO FREQUENCY TELEGRAPH EQUIPMENT WITH ACTIVE FILTERS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 45-50 manuscript received 25 Oct 77

KOROP, B. V., MARTSENITSEN, S. I., TARBAYEV, S. I., STEPANETS, V. A. and YAROSLAVSKIY, L. I.

[Abstract] New audio frequency telegraph equipment has been designed to replace the TT-12 equipment presently used for zone communications, for the purpose of lowering the cost of operating equipment and of the manufacture and maintenance of audio frequency telegraph (TT) equipment. The instability of band filter characteristics has been the key reason for a growth in edge distortion in transmitted binary signals, which has adversely affected the performance of TT channels. A description is given of a filter design which has the required stability of frequency characteristics and does not contain an induction coil (a component inefficient to manufacture). This design is called a "switchable converter filter" (KFP) and is based on the circuitry of a parametric filter with capacitor switching and signal spectrum shifting. This filter belongs to the class of filters employing parametric

circuits and active RC networks and analog switches. The basis of the KFP is a low-frequency filter whose circuitry includes parametric elements in the form of switches which are controlled by an external oscillator which periodically closes the switches at a given frequency, f_1. The KFP's circuitry has the properties of a band filter with a center frequency precisely equal to the frequency of the control oscillations, f_1, and a characteristic curve whose shape matches that of the characteristic of the basic low-frequency filter. By employing frequency f_1, which is quartz stabilized, it is possible to achieve high stability of the filter's frequency characteristic. The KFP is formed by replacing each capacitor of the original low-frequency filter with a set of switches and capacitors. The operation of the KFP is examined in detail. A block diagram is given of a TT equipment unit employing a KFP. The design features of this unit rely on the properties of the KFP. The stability of the frequency characteristic of KFP's is more than an order of magnitude better than that of LC filters, because of quartz stabilization of the center frequency of the passband. The total power requirement per channel, taking into account the efficiency and power factor of the secondary power supply for the equipment, is 2.5 VA, as compared with 11 VA for the TT-12 equipment. A rack accommodating 144 TT channels occupies 2600 x 600 x 225 mm of space and weighs no more than 300 kg. The new equipment makes it possible to bring the tuning norm for the magnitude of edge distortion close to the maximum permissible (nine percent), thus making it possible to operate with a reduced signal-to-noise ratio in telegraph frequency channels. The need for alignment is eliminated, for the KFP requires only a check of its good working order. Unification of the channel module makes manufacturing simpler and less expensive. Figures 6; references 6: 5 Russian; 1 Western.

USSR

UDC 621.394.346

PRINCIPLES OF THE DESIGN OF MESSAGE SWITCHING CENTERS FOR A GENERAL-USE TELEGRAPH NETWORK

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 25-31 manuscript received 13 Dec 77

ADZHEMOV, S. A., MATEVOSYAN, K. A. and SHVARTSMAN, V. O.

[Abstract] A computer-controlled electronic message switching center (TsKS) for use in telegraph centers is described. The purpose of this TsKS is to eliminate the effect of overloads with an increase in telegraph traffic, resulting in decreased carrying capacity and operating stability, as has been evidenced by a peak-load delay of 17 min in establishing connections. A model of a telegraph TsKS has been designed which employs the YeS-1030

computer and has a maximum carrying capacity of three messages per second. This TsKS has been tested in Yerevan and has formed the basis of an experimental automated general-use telegraph network for the Armenian SSR. Improved models of TsKS's based on new computer models are scheduled to be put into service in cities other than Yerevan in order to complete the network. A description is given of the structure and capabilities of a TsKS, which is used primarily in large general-use telegraph networks whose mean annual handled load amounts to more than 100,000 messages. The hardware of a TsKS includes a unit for linking the computer with the communication channels; this unit forms characters or message blocks out of discrete messages arriving in sequence through these channels, transforms their level and checks for distortions, and transmits these message blocks or characters to a main memory. Message arrays formed in the main memory are transferred, after analysis and processing, to external storage units of large capacity, for putting into order for transmission to the communications channel, and for archiving. In transmission, messages are read out of the external storage units into the main memory and are fed via the link in sequence into the communications channels. Control of the switching process and monitoring of the state of the TsKS and communication channels are carried out by a software system and function-testing and control service. The latter provides for intervention of an operator when critical and unforeseen situations arise. Then the switching process is controlled semiautomatically from special telegraph exchange and display panel locations. The design of a TsKS is discussed in detail from the viewpoint of carrying capacity, reliability and cost. Carrying capacity is characterized by the number of messages passing through the system per unit of time and is determined by the ratio of the output, or speed of response, of the computer to the number of operations required to process a single message with an average length of 300 characters. The relationship between carrying capacity and software design is discussed. Reliability is estimated on the basis of continuous round-the-clock operation of the TsKS. The relationship between appropriate configuration of the TsKS's structure and this criterion is discussed. Hardware is chosen out of considerations of cost. An argument is advanced in favor of employing unified-system (YeS) computers, based on the flexibility of this general-purpose system. Figures 2; tables 2; references: 2 Russian.

USSR

UDC 621.394.763

'NIKOLA TESLA' TYPE D TELEGRAPH EXCHANGE

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 31-35 manuscript received 10 Sep 77

KRICHEVSKIY, E. N. and VRAZHNOV, V. N.

[Abstract] The type R crossbar-system channel-switching telegraph exchanges manufactured by the Yugoslav Nikola Tesla firm in Zagreb and used presently in Moscow, Leningrad, Kiev and Minsk do not meet the requirements of the 200-baud data transmission network which has been created in the Soviet Union. To meet these requirements and to allow for the long-term development of switching equipment, a new type D exchange has been developed and readied for series production. An experimental model was put into service in 1976, and these new exchanges have begun to be introduced in 1978. The features which distinguish the new type D from the old type R are discussed here, such as the extensive application of transistors and integrated microcircuits, the new design principles utilized for registering and scaling equipment, the capability of relaying information through the exchange at a maximum rate of 200 bauds, and the capability of simultaneously connecting users of different categories to the user selection stage. A simplified structural diagram of a type D exchange is given, as well as a comparative table of technical characteristics of type R and type D exchanges. The exchange consists of two main units: an AST-K60/D terminal station, and an MMS-K57 telex/D tandem exchange. The AST-K60/D consists of user selection stage blocks with a maximum capacity of 400 points of connection each, GBX-D and KMT-D control units, markers, and other equipment. Terminal stations of all categories can be connected to LRD user sets, including data transmission, message relay and automated telegraph stations. A maximum of 10 categories of terminal stations can be connected to the AST-K60/D. The MMS-K57 telex/D tandem exchange consists of group selection stage blocks with a capacity of 200 points of connection each, or a maximum of 20 two-way or 20 incoming and outgoing blocks, registering and scaling equipment, and other auxiliary equipment. New design principles have been utilized for registering and scaling equipment to execute the new requirements for programming and receiving and transmitting a number in different codes. This equipment consists of registers, analyzers and receivers for numbers in decade and telegraph codes, and corresponding number transmitters. The registers are general-purpose and consist of two functional units, one of which interacts with the other equipment of the exchange and is unalterable, and the other of which consists of units whose logical functions are determined by a variable program and depend on the characteristics of the section of the network in which the register in question operates. The capabilities for analyzing dialing information have been expanded by the addition of an analyzer of simple design, serving 25 registers. The GBX-D control unit, telegraph code detectors, pulse generator and telegraph combination generator for rates of 50 and 100 bauds have been made

totally electronic. The utilization of advanced components is expected to enhance the reliability of the type D exchange. Figures 1; tables 1; references 4: 3 Russian; 1 Yugoslav.

USSR UDC 621.395.1

FEATURES OF DATA TRANSMISSION EQUIPMENT SIGNAL CONVERTERS

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 50-54 manuscript received 23 Nov 77

TAMM, YU. A.

[Abstract] Aspects of the design of modern signal converters, which serve as the link between digital terminal equipment and the communications channel in data transmission equipment, are discussed. Areas covered are types of modulation, methods of compensating inter-character distortion, signal processing methods, ensurance of code transmittance, enhancing the fidelity of transmitted information, interfacing with peripheral equipment, and problems in implementation of signal converters. In the latter regard, the creation of high-speed units is still relatively complex and expensive, but success in this area is foreseen in the not-too-distant future. Large-scale integrated circuits are being employed, and mahy modern converters are the size of an average book. The employment of microprocessors in the design of signal converters is regarded as a promising trend. The two major interfaces employed are channel and terminal interfaces, and for interfacing with other equipment of the system more frequent use is being made of fiber optics to ensure high fidelity of the transmitted signal with small-sized cables and low component cost. Enhanced fidelity is provided by the selection of optimal forms of modulation and methods of reception and by employing coding methods which provide for a certain degree of informational redundancy in the transmitted signal. Signal processing methods have been influenced most by the development of microelectronics, e.g., by the employment of analog-digital converters to convert the signal immediately into digital form as soon as it arrives in the receiver from the communications channel, with subsequent operations being performed solely on digital principles. Code transmittance is defined as the ability of a signal converter to transmit any information combination without deterioration in transmission quality occasioned by the type of combination. Synchronous and recurrent scrambler-descrambler systems are mentioned in this regard. The problem of overcoming inter-character distortion has grown in proportion to the increase in rates of transmission. The main problem here is the instability of the system's frequency characteristic. Channel correctors and signal correctors have been employed to correct this problem. The higher the transmission rate, the more complex, and the larger, the correcting equipment, which is in many instances the largest piece of

equipment. Modern signal converters use all three main forms of modulation (frequency, phase and amplitude), either individually or in combination. The best noise rejection is achieved with phase modulation, which forms the basis of the design of all high-speed and the majority of medium-speed signal converters. Combined AM and PM modulation is employed for rates of 7200 and 9600 bits per second. The simplicity of designing FM equipment has been responsible for the use of FM for transmission rates of up to 1200 bits per second, inclusive. Figures 3; references 9: 7 Russian; 2 Western.

USSR UDC 621.395.5:621.372.544

EXTRACTION OF CHANNELS FROM A DIGITAL GROUP SIGNAL IN A PULSE-CODE-MODULATION SYSTEM WITH FREQUENCY DIVISION

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 8-13 manuscript received 30 May 77

GOL'DENBERG, L. M. and MATYUSHKIN, B. D.

[Abstract] A method is shown by which individual channels can be extracted from a digital group signal x(t) in a k-channel PCM FD system and, at the same time, the spectra of channel signals can be shifted into the low-frequency $(0, \Delta\omega)$ range. An m-level digital filter array is used for this consisting of m low-pass filters and m high-pass filters. The principle is illustrated first for the simplest case of a 2-channel digital group signal, with the use of an ideal digital filter pair. The synthesis of a multilevel filter array is shown next and found to be, with approximately twice as many filters, $2^{m-1}/m$ times faster than an equivalent array of band filters for channel extraction. Figures 5; references: 3 Russian.

USSR UDC 621.396

A MATCHING DEVICE FOR JUNCTION CIRCUITS

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 70-73 manuscript received 1 Dec 77

PLOTNIKOV, V. G. and PRIVALOV, YU. I.

[Abstract] A matching device for junction circuits has been developed, the purpose of which is to equalize their frequency characteristics as well as

to compensate the attenuation along four pairs of nonpupinized TZ and TDZ low-frequency cables which connect the radio control room with radio centers. The device consists of an attenuator pad for controlled stepwise attenuation of the input signal to one level, an equalizer for correcting any frequency distortions produced by the junction circuits, and an amplifier. The attenuator pad consists of 7 T-sections, a proper combination of which will reduce the input signal to the -23 dB level. The equalizer is a fourpole T-bridge with two autotransformers and an LC-network across each. The slope of the attenuation-frequency characteristics is regulated by adjustment of the autotransformers and the variable resistor across each arm. This device can be installed either in the radio control room or in a radio center, preferably at the end rather than the beginning of the junction circuit. Figures 4; references: 4 Russian.

USSR UDC 621.396

EFFECT OF THE AMPLITUDE DISTRIBUTION OF SIGNALS ON THE PROBABILITY OF CORRECT DETECTION

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 88-91 manuscript received after completion, 3 Jun 77

DUNAYEV, A. S. and SHEMSHEDINOV, R. B.

[Abstract] The probability of correct signal detection, in the case of a Gaussian noise, is calculated for four different distributions of the signal amplitude (Gaussian, uniform, gamma, and chi-squared). Numerical results, presented in the form of graphs for typical values of the distribution parameters, indicate that the probability of correct detection decreases monotonically with an increasing coefficient of amplitude variation. When this coefficient of variation is small, then the probability of correct detection of signals with an asymmetric amplitude distribution becomes equal to that in the case of a Gaussian signal. Figures 2; references 14: 11 Russian; 3 Western.

USSR UDC 621.396.4:621.391.822.2

HOURLY MEAN STANDARD OF NOISE POWER IN TELEPHONE CHANNELS OF RADIO RELAY LINES

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 5-7 manuscript received 24 Aug 77

KALININ, A. I. and NADENENKO, L. V.

[Abstract] The feasibility as well as the expediency of establishing a new standard for noise power in telephone channels of radio relay lines is examined, namely of having the hourly mean not exceeded more than 5 percent of the time in any month instead of a minutely mean not exceeded more than 20 percent of the time in any month. The analysis is based on an evaluation of statistical data on signal fadeout along 9 typical lines of diverse profiles and running 39-62 km in various climatic zones in the European part of the Soviet Union. Distributions of hourly mean noise power are estimated on this basis and the new standard found to be more stringent. Its implementation would require an otherwise unjustified improvement of radio relay systems and their noise immunity by 4-7 dB, inasmuch as the averaging time of one hour is no longer than a telephone conversation. This standard is, therefore, recommended for deletion by the International Radio Consultative Committee. Figures 3; references 6: 3 Russian; 3 International.

USSR UDC 621.396.66

HIGH-SPEED MULTICHANNEL MODEM

Moscow ELEKTROSVYAZ' in Russian No 6, Jun 78 pp 61-64 manuscript received 22 Nov 77

AZAROVA, L. G., DANILEVSKIY, V. A., KALMYKOV, B. P., LEV, A. YU., OTLIVANSKIY, A. L., RAKHOVICH, L. M., RACHKAUSKAS, R. S. and SHPIGEL', I. YE.

[Abstract] A description is given of a multichannel modem designed for transmitting data through primary broadband channels at a rate of 96,000 bits per second. The advantage of modems of this sort is their low sensitivity to the effect of a short-duration drop in level. In addition, they make it possible to reduce considerably the rate of manipulation while maintaining a high rate of data transmission and the demand for nonuniformity of the amplitude- and phase-frequency characteristics of the system as a whole. The modulator's group signal consists of 8 channel signals with carrier frequencies of 68, 72, 76, 80, 88, 92, 96 and 100 kHz. In addition, pilot signals are transmitted at 64 and 84.14 Hz. Each channel consists of two subchannels, a quadrature and in-phase. Channel signals are separated in the demodulator

by means of active filters, which also determine the projections of the signals onto the coordinate axes of the receiver. The modem employs relative coding of transmitted information. The modem's transmitter consists of a coder, a memory, eight manipulators, a control unit, and an adder. The function of the adder is to unite the channel signals of all manipulators into a group signal and relay this signal to the line of the primary channel. Binary information arriving from the source is processed by the coder, memory and manipulators. The control unit generates pulses to set the sequence for execution of operations by all eight units of the transmitter and also forms reference oscillations for the manipulators. The influence of a short-duration drop in level on the fidelity of the data transmitted is compensated in discriminators in the receiver, which determine the magnitudes of in-phase and quadrature projections. For this purpose, the comparison threshold is displayed at each message to match the intensity and duration of the short-duration drop in level in this message. The value of this threshold is determined from the pilot signal transmitted at the center frequency of the group signal and separated by the active filter. The probability of error of this modem when operating "on its own" is 10^{-4} with a signal-to-noise ratio of 21 dB. The signal-to-noise ratio is no greater than 24 dB when operating through a primary broadband channel with the 84.14-kHz rejector filter on and nonuniformity of the frequency characteristic of the time delay generator at 30 μs within the 64 to 83 kHz and 85 to 104 kHz ranges. The employment of the equipment for compensating the influence of a short-duration drop in level makes it possible to reduce the number of errors by a factor of 5, 8, 20 or 40, depending on conditions in the resolving circuitry's threshold levels. Message length equals 333 μs, and the period for processing channel signals in active filters is 250 μs. The modem's transmitter also puts out, in addition to data, a pulse train at a clock frequency for synchronization of output units. The transmitter can be synchronized by external clock pulses from input units. This modem can also operate in the regenerative repeater mode. Figures 3; references: 3 Russian.

USSR UDC 621.396.229

ENERGY LOSSES IN RADIO COMMUNICATION SYSTEMS WITH COMPLEX SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 9-14 manuscript received after completion, 31 Mar 77

SMIRNOV, N. I. and RYZHOV, YE. I.

[Abstract] In radio communication systems with complex phase-manipulated signals the duration of a useful signal may be longer than the period of supply voltage fluctuations. These fluctuations shift the operating points of electron devices and alter the amplitude-frequency as well as the phase-

frequency characteristics of the respective stages. In some system components there occurs a phase shift caused by changes in the oscillation frequency, and in others a phase shift is produced during signal amplification of frequency conversion. The most critical elements are heterodynes, traveling-wave tubes, and i-f amplifiers. The total energy loss in a system caused by all phase shifts affecting a signal is calculated here for the case of optimal signal processing by means of a balanced phase detector with a nearly cosinusoidal small-signal and triangular large-signal characteristic. For better noise immunity, according to the results, the ratio of signal period to voltage fluctuation period should be either equal to 1/2 or as large as possible. Figures 6; tables 1; references: 10 Russian.

USSR UDC 621.396.946

SIMULATION OF A SATELLITE COMMUNICATION SYSTEM WITH MULTISTATION ACCESS

Moscow ELEKTROSVYAZ' in Russian No 5, May 78 pp 51-56 manuscript received 25 Feb 76

UMRIKHIN, YU. D., YERMILOV, V. T. and CHIRKOV, B. I.

[Abstract] For the design of satellite communication systems with multistation access simulation methods are found to be preferable to mathematical models based on the theory of mass service, because the latter are not always analytically adequate or sufficiently universal to cover all possible variants. Here a system is considered which includes n earth stations and a radio relay to the satellite over N_0 channels of one type. The operation of this system, with random access and random message transmission time, is regarded as a stochastic servicing process. The latter is, in turn, represented as a set of mathematical and logic rules with constraints, all structured into an algorithm for computer implementation. The channels can be distributed and used either with directional separation of subtrunks and the earth stations interlinked through the satellite over autonomous communication lines, or with stationwise separation of subtrunks. Furthermore, the subtrunks can be either tied rigidly for a length of time or there is free access for any station through any idle subtrunk. There are thus four possible variants, a program for each having been written in ALGOL. In this way, the satellite communication system can be optimized with respect to channel maneuverability and transmitting capacity. Figures 4; tables 1; references: 10 Russian.

USSR UDC 621.396.962.21.001.2+621.396.962.25.001.2

PECULIARITIES OF THE FORESHORTENING EFFECT WHEN PROBING THE IONOSPHERE IN THE HF BAND

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1121-1128 manuscript received 24 Aug 77

NAMAZOV, S. A. and KOROBEYSHCHIKOV, V. V.

[Abstract] A theoretical analysis is made of peculiarities of the foreshortening effect in the anisotropic ionosphere in the case of probing in the HF band where refraction in the medium must be accounted for in scattering of waves by magnetically oriented nonhomogeneities for combined emission and reception. It is assumed that the regular structure of the ionosphere is known, for instance from vertical probing data, and the fluctuations of electron concentration caused by the presence of magnetically oriented nonhomogeneities are small and do not disrupt the average properties of the plasma, so that their influence on the trajectories of the beams in the ionosphere can be disregarded. A description is given of the method of calculating the surface of orthogonality which determine the region of formation of backscattering signals. An investigation is made of the geometry and peculiarities of these surfaces, and it is shown that when the geometry of the echo surface is known in the case of an undirected antenna one can determine the spatial position, extent, direction and rate of displacement of the perturbed region of the ionosphere from the time delay and Doppler shift of the frequency of diffuse reflections over a long time period, or determine the time behavior of signals as a function of the spatial location and direction of motion of this region. Figures 6, references 3: 2 Russian; 1 Western.

USSR UDC 681.84.087.4

PHASE DISTORTIONS DURING MAGNETIC RECORDING OF SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 44-58 manuscript received 10 Sep 77

VICHES, A. I. and SMIRNOV, V. A.

[Abstract] Phase distortions in a magnetic recording-and-playback channel can be estimated only in the case of linear transmission characteristics, i.e., with h-f or d-c bias magnetization, and in the case of modulational recording. As the major sources of phase distortions, as well as frequency distortions, are regarded the magnetic components of recording and playback heads, the recording process, the playback process, the asymmetry of the main gap, and the auxiliary electric devices. Of all the methods considered

in the present paper for measurement of the phase-frequency characteristics, the multifrequency method is found to be the only one suitable for determining phase distortions. The application of this method to magnetic recording apparatus is analyzed theoretically and some results obtained experimentally are discussed. According to these results, phase distortions during modulational recording are determined essentially by the characteristics of the low-pass filters. On the other hand, in the case of precise direct recording with special phase correction, the main sources of phase distortions are the differentiating circuits of a-c amplifiers, and in magnetophones these sources are the amplitude-frequency-characteristic correcting networks. Figures 10; tables 2; references 16: 11 Russian; 1 German; 4 Western.

CZECHOSLOVAKIA

STATIC SUPPRESSION OF INTERFERENCE USING DOUBLE-SHIFTED NONSYNCHRONIZED SIGNAL TRANSMISSION

Prague SDELOVACI TECHNIKA in Czech Vol 26 No 3, Mar 78 p 101

COUFAL, JAN

[Abstract] Transmission of electromagnetic signals is affected by interference from atmospheric disturbances and industrial operations. To avoid such interference a wide-frequency zone or a narrow directional transmission zone are used. These means are not applicable at low transmission frequencies. Then a non-synchronized multiple transmission is needed. The design of a dual transmitter is shown in a diagram and is accompanied by a description. Operation of a dual signal requires high accuracy of modulation and demodulation. A good design uses a diode bridge supplied with both the positive and negative currents, and provided with two inputs and an output with a memory capacity. The method of double shifted non-synchronized transmission reduces the effects on interference from all sources. It may also be used to improve the quality of commercial radio and television broadcasts. The main problem is a suitable design for the delay circuits. Figures 2.

GDR

DETERMINATION OF THE RELIABILITY AND AVAILABILITY PARAMETERS OF COMMUNICATIONS-ENGINEERING AND DATA-PROCESSING SYSTEMS

East Berlin FERNMELDETECHNIK in German Vol 18 No 3, 1978 pp 108-109

FARKAS, G., Budapest

[Abstract] The ratio between realized and required performance indicates the quality and reliability of the service. This quality criterion may be interpreted in global and local terms. A fault in a given part of the system deteriorates the value of the local parameter in the given area, usually also deteriorates the value of the global parameters, and in some circumstances may even improve the value of a local parameter. A simple example is described to illustrate the latter. It is demonstrated that the specific cases discussed merely represent extreme cases of a general relationship. A reliability model may be devised to permit the real-life situation to be better expressed than with the classic methods available today. In interpreting the state of a system, it is necessary to take into consideration the fact that simultaneous operation of individual units requires conditions which are determined by the operating conditions and the tasks concerned,

and these conditions may vary as time goes on. The approach discussed is theoretically suitable for all kinds of systems; however, in the case of complex systems the computations become very extensive. An additional disadvantage of the approach is the fact that it provides only a probability variable so that the states of the units (quality state, loading) mutually affect each other. Iteration or simulation methods are then additionally required. References 7: 1 Russian; 2 German; 1 Hungarian; 3 Western.

GDR

ONE HUNDRED AND TWENTY-FIVE YEARS OF UNDERSEA CABLE ENGINEERING

East Berlin FERNMELDETECHNIK in German Vol 18 No 5, 1978 pp 164-167

MEYA, P. and PRENZLOW, H. G., Chamber of Technology, East Berlin

[Abstract] The first telecommunications cable was laid under the sea 125 years ago. Today there are cables as deep down as 4,000 meters. The manufacture and deployment of the cable requires extraordinary competence and attention since the projects are very expensive. The authors present a review of the undersea telegraphy cables, low-frequency cables, carrier-frequency cables, underwater amplifiers, and transoceanic cables, describing briefly how the technologies of manufacture and deployment have developed. Current development trends are in the direction of using broadband amplifiers on a solid-state basis. It is now also possible to use a 45 MHz system which permits the transmission of 4140 channels, 4 kHz apart, or 5520 channels, 3 kHz apart. The ITU (International Telecommunications Union), in cooperation with the CCITT, developed a switching design for telecommunications which envisages the establishment of transit-traffic centers connected to high-quality transmission circuits. The next cables to be deployed in the Mediterranean, the South Atlantic, the Indian Ocean, and the Far-Eastern seas will be designed on the basis of this principle. Figures 2; references 9: 5 German; 3 Western.

GDR

VARIABLE SYSTEM DISTORTION ELIMINATOR IN THE LINE AMPLIFIER RACK OF THE VLT 1800/1920 COAXIAL LINE SYSTEM

East Berlin FERNMELDETECHNIK in German Vol 18 No 5, 1978 pp 168-170

SCHULTZ, R. and BUTTGEREIT, A., East Berlin

[Abstract] The VLT 1800/1920 coaxial-line system is manufactured in the DDR for 2.6/9.7 mm and 1.2/4.4 mm wires, rated at a constancy of ±0.1 dB over the entire frequency range of 308 to 8544 kHz. The system exhibits a static distortion caused by the line amplifier, and a seasonal dynamic distortion caused by the difference between the temperature-dependent damping change of the cable damping system and the amplification change in the regulated line amplifier. After reviewing known methods for system distortion elimination in such cases, the authors briefly describe and illustrate (with block diagrams) an approach representing the variable system distortion eliminator. The eliminator, designed for the 0.27 to 8.5 MHz range, features seven resonance circuits, wherein the circuits may be switched in amplitude, bandwidth, frequency, and polarity, so that a high degree of flexibility is achieved. The system is also suitable for elimination of distortion caused by variable static amplitude faults. The flexibility of the system may be utilized in eliminating distortions in carrier-frequency baselines where asymmetric residual faults in the originally cleaned-up sectors add to the systematic portions of the new sectors. Figures 4.

GDR

PCM COAXIAL CABLE SYSTEMS - A COMPARATIVE REVIEW

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 28 No 6, 1978 pp 231-235 manuscript received 14 Mar 78

HUNECK, M., Information Engineering and Theoretical Electrical Engineering Section, Ilmenau Technical College

[Abstract] The literature dealing with PCM coaxial cable systems is briefly reviewed and tabulated data are presented with respect to the bit frequency, number of telephone channels, cable and repeater distance, code, transmitted signal, probe ratio, transmission amplitude null peak, transmission peak power, signal-to-noise ratio, noise coefficient, cable attenuation, receiver pulse form, receiver pulse spectrum, total channel, jitter, repeater power consumption, and so forth of PCM coaxial table systems made by GEC, Plessey, STL/STC/ITT, Fujitsu, Marconi, Philips, CNET, OKI, Bell-Northern, Bell (USA),

NTT, and Telecomm. Adm. (Norway). While the data shown, based on information from the respective manufacturers, are generally valid, they are not always adhered to in each and every installation. The differences in specific parameters among the individual manufacturers can often be explained on the basis of differences in other manufacturing parameters, because the individual parameters are often interrelated. Figures 3; tables 2; references 60: 10 German; 5 Japanese; 45 Western.

GDR

DEMODULATION OF JITTER-PERTURBED PAM SIGNALS

East Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Vol 28 No 6, 1978 pp 249-252 manuscript received 7 Mar 78

KIRMSE, W., Information Engineering and Theoretical Electrical Engineering Section, Ilmenau Technical College

[Abstract] Theoretical considerations, tests, and evaluation of the test results concerning the effects of random timing pulse perturbances on the PAM signals in demodulated low-frequency signals are presented. The complex problem was significantly simplified by using a theoretical system model which describes the transmission of harmonic, determined useful signals, as well as linearizing approximations for small modulation levels. The transmission functions derived on this basis show some of the effects, specifically the fact that the PAM clock jitter affects the received signal as a carrier jitter. The results of the theoretical considerations were confirmed by measurements. The transmission behavior under such perturbance is determined, with the jitter parameters being constant, by the signal frequency, the scanning frequency, and the properties of the demodulation low pass (especially limit frequency and frequency response in the pass range). Figures 5; references 5: 4 German; 1 Western.

HPR

MATTERS CONCERNING THE FIRE RESISTANCE OF TELEPHONE EXCHANGES

Budapest BHG ORION TERTA MUSZAKI KOZLEMENYEK in Hungarian Vol 24 No 2, 1978 pp 80-83

Mrs FARKAS, PETER, dr, graduate biologist, group leader/engineer, Product Testing Department and Mrs RADAI, SANDOR, graduate chemical engineer, laboratory engineer, Product Testing Department, BHG [Beloiannisz Communications Engineering Factory]

[Abstract] Although there are many national and international standards governing the fire resistance of electrical engineering facilities such as telephone exchanges, universal standards for the flammability testing of components and units in telephone exchanges are still under development at the IEC [International Electrical Engineering Committee]. Basically, the fire resistance of a telephone exchange is evaluated in terms of (1) the environment of the exchange and the operating conditions; (2) the flammability characteristics of the components and units; and (3) the possible propagation of a fire. There are parts and units representing primary and secondary fire hazards. The extent of fire they may cause may be small, medium, and large. The fire may be self-extinguishing or non-self-extinguishing. There are standardized and specialized test methods used to determin the flammability parameters, such as instruments to determine the so-called oxygen index. The needle-flame ignition source is better in these instruments than the incandescent-wire ignition source. Figures 5; tables 1; references 5: 2 Hungarian; 3 Western.

HPR UDC 621.315.211:621.395.743:665.772.3

QUALITY OF OUR VASELINE-FILLED LOCAL TELEPHONE CABLES

Budapest HIRADASTECHNIKA in Hungarian Vol 29 No 4-5, Apr-May 78 pp 98-103 manuscript received 26 Jan 78

IPOLYI, ISTVAN

[Abstract] The Hungarian Cable Works developed and started the manufacture of a line of vaseline-filled cables to be used by the Hungarian Postal Service for local telephone traffic. The products are made in a new shop in the Works' Szeged cable manufacturing facility. The cables, intended for domestic use and export, are fully waterproof and meet the applicable standards of the telephone services of the prospective export target countries. The average operational capacity of the cables is up to 46 nF/km. The manufacturing

equipment was imported from abroad, but the manufacturing techniques and the product quality represent domestic developments. Factory test data are presented for insulation resistance (much better than 1,600 mohmkm), crosstalk resistance, operating performance parameters, capacitive coupling, and the like. Results of trial installations will be available in the near future. It appears that the provisions of the applicable Hungarian, British, German, and Norwegian standards are met. The cables are expected to operate in a reliable manner and compare favorably with comparable foreign products. The crosstalk resistance is especially good, and exceeds the requirements of all foreign standards and the performance of all foreign products with which the cables were compared. The factory's next goal is to develop the manufacture of products covered by British Standard BS 3573:1972). Figures 11; tables 2; references 7: 3 Hungarian; 1 German; 3 Western.

HPR UDC 621.315.211:621.395.73:665.3:667.73

PRODUCTION OF VASELINE-FILLED LOCAL TELEPHONE CABLES AT HUNGARIAN CABLE WORKS

Budapest HIRADASTECHNIKA in Hungarian Vol 29 No 4-5, Apr-May 78 pp 104-112
manuscript received 26 Jan 78

IPOLYI, ISTVAN, KALMAN-PIKO, ISTVAN and RONAI, MIKLOS

[Abstract] Manufacturing methods used at the Hungarian Cable Works to produce vaseline-filled telephone cables for local traffic are briefly described and illustrated by photographs. The cables use 0.4, 0.6, and 0.8 mm diameter copper wires and are made in versions containing 5, 10, 15, 25, 50, 75, and 100 quadruple wire strands. The equipment used in the manufacturing process includes Niehoff wire-drawing machines, Maillefer BM 80 wire-insulating machines, Union Carbide PN 225/3 insulator with Union Carbide PZ 157 colorant, Maillefer CT doubling machines, Pourtier Type 1000 winders, Pourtier Type 2200 winders-twisters, Felten & Guilleaume vaseline fillers, Silkolene Grade 947 vaseline from Dalton, and Maillefer BM 120 braid-sheathing machines. The Postal Testing Institute developed a fast (30 minute) method for testing the cables for water resistance which provides the results obtained by the method described in Germany for the West-German Federal Postal Service but is much faster. Full production has already started. The cables meet all applicable standards at home and abroad in terms of insulation resistance, d.c. resistance, operating capacitance, capacitive coupling, electrical resistance, crosstalk, and water resistance. Figures 23; references 9: 1 Hungarian; 2 German; 6 Western.

HPR UDC 621.315.212:669.717

SMALL COAXIAL CABLE WITH ALUMINUM CONDUCTOR

Budapest HIRADASTECHNIKA in Hungarian Vol 29 No 4-5, Apr-May 78 pp 147-149
manuscript received 26 Jan 78

KOROSI, ANDRAS and PINTER (Mrs DUDAS), MARTA

[Abstract] Some theoretical considerations are presented concerning the design of small coaxial cables with an aluminum conductor, basically representing an aluminum-core, aluminum-external conductor, polyethylene-tube sheath system. In designing a coaxial cable of this kind, the primary requirements are longitudinal and transverse water resistance, concentricity of the core and external conductor, and low dielectric resistance. A combination pipe-disk insulator system permits satisfactory parameters to be achieved in these requirements. The provisions of domestic and foreign standards, as well as commercial requirements, form the basis of a specific designing operation. A design procedure for a specific small coaxial cable was briefly described, and the effects of changes in some of the parameters were discussed. Mechanical shielding and electrical shielding of the emplaced cables was briefly touched upon. By using the proper designing techniques, the required coaxial-pair dimensions and electrical parameters can be achieved. Figures 2; references: 1 Hungarian.

HPR UDC 621.315.212.011

DISTRIBUTION OF THE TECHNOLOGICAL PARAMETERS OF TYPE SZ-5 SMALL COAXIAL CABLES, AND EVALUATION OF THE CABLES OF ALREADY INSTALLED LINES

Budapest HIRADASTECHNIKA in Hungarian Vol 29 No 4-5, Apr-May 78 pp 119-128
manuscript received 26 Jan 78

NADASI, LASZLO and CSONKA, JANOS

[Abstract] The small coaxial cables, Type Sz-5, made at the Hungarian Cable Works with equipment procured from the French firm SAT to SAT specifications. The first export lot for an approximately 220 km line was delivered to the Soviet Union in 1975. Quality control is carried out at various stages of manufacture and on the finished cables. The tests include the quality parameters of the materials used: d.c. resistance, insulation resistance, operating capacity, crosstalk, wave impedance, smoothness, terminal impedance, wave attenuation, electrical resistance, and so forth. Special tests are carried out for the transmission parameters (wire-pairs, quadruple wires, k_1 joints, tube joints, terminal impedances, reflection, and length). These tests and

some typical results obtained with them are briefly described and discussed. Manufacturing wastage is minimal, and the products fully conform to the provisions of the applicable domestic and foreign standards. Maximum reflection just meets the requirements; improvements have been planned and are in the process of being implemented. Operating experiences with installed lines are favorable. The fluctuation of the technical and operating parameters is small, and this fact contributes to the satisfactory performance of the installed lines. Figures 29; tables 1; references: 6 Hungarian.

HPR UDC 621.315.212.011:621.395.74:622.691.4+622.692.4

CABLES FOR THE COMMUNICATION SYSTEM OF GAS AND OIL PIPELINES

Budapest HIRADASTECHNIKA in Hungarian Vol 29 No 4-5, Apr-May 78 pp 140-146
manuscript received 26 Jan 78

PINTER (Mrs DUDAS), MARTA

[Abstract] A complex technological communication system was developed by Hungary for the Soviet Union for use in gas and oil pipelines, on the basis of an intergovernmental agreement between the two countries. The system is designated BK-300/G and its main parts are made at the Hungarian Cable Works. The system operating over joint cables, features (1) an UHF transmitter-receiver system in conjunction with an audio-frequency regional dispatcher and telemechanical transmission unit, and (2) a long-distance carrier-frequency unit for transmission trunk lines. Coaxial cables, of 1.2/4.4 mm size, are used. The following main systems are supplied: combination small coaxial cable for 300 channels, transmission-type 300-channel coaxial-cable system, microwave devices, mobile UHF communication units, and data-transmission units. The cable has four 1.2/4.4 mm copper conductors, three 1.2 mm copper conductors, and six 0.9 mm copper conductors, with polyethylene insulation. Various types of sheathing are supplied for the different end uses. The engineering and electrical parameters of the coaxial pairs, quadruple star junctures, and insulated wires are presented in tabular form and are discussed. The cables conform to the provisions of the CCITT guidelines for 960-channel cables. Expansion from 300 to 960 channels is feasible. Figures 13; tables 1; references: 2 Hungarian.

USSR UDC 535.3/.5

LOSSES IN A MULTIMODE TWO-LAYER FIBER WITH RANDOM AXIAL BENDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1135-1144 manuscript received 8 Jun 77

SHATROV, A. D.

[Abstract] A theoretical study is done on the statistical properties of beams propagating in a multimodal two-layer fiber with random bends of the axis. The analysis is based on general expressions which define the coefficients of the Einstein-Fokker equation in terms of the spectral density of random deviations of the fiber axis. A detailed examination is made of the case where the spectral density is described by a power-law function. In this case an asymptotic solution of the Einstein-Fokker equation is found which is valid for long fibers. The author thanks B. Z. Katsenelenbaum and R. F. Matveyev for interest in the work.

USSR UDC 62-50

DETERMINING FILTER RESPONSE TO AN UNTAILORED SHORT PULSE

Novocherkassk, IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 p 438 manuscript received 30 May 77

KORSHUNOV, YURIY MIKHAYLOVICH, dr in technical sciences, professor, Ryazansk Radio Engineering Institute; and FILATOV, YURIY ANATOL'YEVICH, senior engineer, Ryazansk Radio Engineering Institute

[Abstract] If a short pulse f(t) acts on a filter with a given transfer function, the response is given by a function with intensity equal to pulse area, i.e.

$$g(t) = Sw(t - t_0), \qquad (1)$$

where w(t) is the weighting function of the filter and t_0 is the time of application of the pulse function at the filter input. The authors consider the problems of selecting t_0 and defining the sufficiently short pulse duration for accuracy of calculation. It is shown that

$$t_0 = \frac{1}{S}\int_{t_1}^{t_2} \tau f(\tau)\, d\tau \qquad (2)$$

for pulse duration $(t_2 - t_1)$. If the pulse response is figured from some time t' within or on the boundary of (t_1, t_2),

$$g(t) = Sw(t - t') + w'(t - t')\int_{t_1}^{t_2}(t' - \tau)f(\tau)d\tau. \qquad (3)$$

USSR UDC 621.316.825.2

A METHOD OF CALCULATING FAMILIES OF STATIC CURRENT-VOLTAGE CURVES FOR POSITORS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 427-431 manuscript received 15 Jul 75, after completion 1 Apr 76

STASHUK, VADIM DANILOVICH, candidate in technical sciences, docent, Kiev Professional Institute; and PANCHUL, VLADIMIR ALEKSEYEVICH, junior scientific worker, Kiev Polytechnical Institute

[Abstract] In a previous paper, V. D. Stashuk proposed a method of calculating a family of static current-voltage characteristics of a thermistor from two known characteristics of this family corresponding to two values of the ambient temperature. In this procedure it is assumed that rays emanating from the coordinate origin of the curve-plotting system are equitemperature lines. Now the authors do experiments to determine the form of equitemperature lines that would enable extension of this technique to varistor-thermistors, and in particular to posistors. A pulse method was used in the experiments for plotting the current-voltage curves. It is shown that the pulse curves are suitable as equitemperature lines because in this case heating is negligible and the posistor temperature remains nearly equal to the ambient temperature throughout the measurement period as the applied voltage is changed. It is shown that a family of static current-voltage characteristics can be calculated for a positron if two curves of this family are known, and if two pulse curves can be plotted. The experimental curves should be taken at temperatures that differ by 70-90 percent of the temperature range of the family. Comparison of calculations with experiment shows that the method is accurate within at least 5 percent. Figures 3; references: 3 Russian.

USSR UDC 621.317.1:621.391.8

AN ANALOG MATCHED FILTER FOR WALSH SIGNALS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 3, 1978 pp 67-71
manuscript received 19 Jul 77

ZHUKOBORSKIY, V. M. and LIVSHITS, YA. SH., Astrakhan Technical Institute of the Fish Industry and Fisheries

[Abstract] Two approaches are possible to a synthesis of a method filter for Walsh functions, according to the way the characteristics of the filter are described -- the frequency approach and the time approach. Using these two methods, the authors determine the structure of matched analog circuits for optimum filtration of binary orthogonal Walsh signals for information measurement systems. The frequency method of synthesis is based on the relation between the transfer function of the filter and the signal spectrum, while the time approach is based on the pulse characteristic of the filter. Block diagrams are given of matched Walsh filters synthesized by these two techniques. Both structures can be realized on the basis of standard analog devices including those using integrated circuitry. Comparatively long delay times of the order of 1 ms can be realized in the case of Walsh functions with a large time base in a wide passband by using magnetostriction delay lines. Filters synthesized by the techniques proposed in this work have been tested for workability in parallel transmission of discrete data and can be used in a broad range of data processing systems where binary orthogonal signals are the basis signals. The paper was recommended by the Department of Electrical Engineering. Figures 3, references: 3 Russian.

USSR UDC 621.372.54

ON THE ASYMMETRY OF AMPLITUDE-FREQUENCY CHARACTERISTICS OF A SYNCHRONOUS FILTER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 4, May 78 pp 1097-1100 manuscropt received 21 Jul 76

TEPIN, V. P. and KHRISTICH, V. V.

[Abstract] In a widely used modification of the synchronous filter principle, a certain number of channels are connected in sequence to the load, and each channel has a given transfer function. If these channels take the form of low-frequency filters, the main lobe of the amplitude-frequency response for such a filter has the properties of a bandpass filter with center frequency coinciding with the commutation frequency. The expression derived for the

transfer function of such a filter in previous research is valid only for an infinitely narrow passband. In this paper, a transfer function is derived for arbitrary selective properties of channel filters, and it is proved that the main lobe of the amplitude-frequency response is asymmetric for a synchronous bandpass filter of the given type. The results were experimentally confirmed. Figures 2; references: 3 Western.

USSR UDC 621.372.8

DISTRIBUTION OF AVERAGE INTENSITY IN CLOSED QUASI-OPTICAL WAVEGUIDE WITH FLUCTUATING IMPEDANCE OF ONE OF THE WALLS

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 6, 1978 pp 865-874
manuscript received 3 May 76

PUZENKO, A. A., Institute of Radio Physics and Electronics, Ukrainian SSR Academy of Sciences

[Abstract] A previous work by A. A. Puzenko and Ye. V. Chayevskiy [IZV. VUZ: RADIOFIZIKA, 21, No 6(1978)] derives an integral equation of the second kind with respect to the function of the mutual coherence of a field in a waveguide with fluctuating impedance on one wall. In the case of large-scale nonuniformities of the impedance, a solution of this equatioh is obtained which describes the function of the mutual coherence in the region of multiple scattering. The present work, taking space filtration into consideration, significantly simplifies the integral equation. The case of small-scale nonuniformities is considered in detail. With the condition of a one-mode excitation of the waveguide, the distribution is found of the average intensity of a field in a cross ection of the waveguide at long distances. At sufficiently long distances the average intensity is distributed uniformly with respect to the section of the waveguide except for the narrow zones adjoining the boundaries. With an increase of the distances the scale of the zones is decreased in accordance with the power law. The author thanks I. M. Fuks and V. D. Freylikher for helpful discussions which contributed a deeper understanding of the process of multiple scattering in a waveguide. References: 5 Russian.

USSR UDC 621.372.8-758

APPLICATION OF STATISTICAL MODELING TO INVESTIGATION OF THE INFLUENCE THAT THE METHOD OF WAVEGUIDE INSTALLATION HAS ON WAVE PROPAGATION IN THE WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1145-1151 manuscript received 30 May 77

KAGAN, A. YA. and KERZHENTSEVA, N. P.

[Abstract] A solution is found for the problem of losses in a waveguide on supports in a protective tube with consideration of the random nature of deformations of the waveguide and the tube and the relation between these deformations and the characteristics of installation underground, i.e., soil elasticity, unevenness of the base and so forth. An analysis is made of the influence that curvature of the axis of an underground installation of this type has on wave transformation in the waveguide. Practical experience has shown that other kinds of deformations have much less influence on wave transformation. The approximation does not restrict the amplitude of the waves that arise, and assumes only weak coupling between these waves. Only the incident wave and one of the resultant waves propagating in the positive x-direction are considered. This reduces the problem to a system of two first-order linear differential equations. The solution is found by a Monte-Carlo method with consideration of a large number of initial mechanical and electrical parameters. It is shown that for lengths of more than 10 times the spacing between rigid supports, the absolute conversion losses in the waveguide are quite low throughout the entire band -- less than 0.1 dB/km. Neither the use of flexible supports nor an increase in the number of supports will give any appreciable reduction of the overall losses. Figures 3; references: 4 Russian.

USSR UDC 621.372.822

EXPERIMENTAL STUDY AND COMPARATIVE ANALYSIS OF DIELECTRIC STRIPLINES FOR THE MILLIMETER BAND WITH VARIOUS WAVEGUIDE ORIENTATIONS IN THE SUBSTRATE

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 7, Jul 78 pp 1028-1036 manuscript received 11 Apr 77; after completion, 25 Oct 77

AVERIN, S. V., MEL'NIKOV, A. V., MURMUZHEV, B. A., POPOV, V. A. and SALAMATIN, V. V., USSR Academy of Sciences, Institute of Radio Engineering and Electronics

[Abstract] The performance of dielectric striplines, namely rectangular polyethylene waveguides (AxB = 4.7 x 2.3 mm^2) molded into matching grooves

(4.7 x 2.3 or 2.3 x 4.7 mm^2) fluorocarbon substrates, was studied over the 1.5-2.5 mm range of wavelengths. The field distribution, the losses, and the dispersion characteristics were measured in the experiment. A comparative analysis of the results indicates that striplines with the dimensions $A < B$ are superior in performance at this end of the millimeter band. The authors thank V. F. Vzyatyshev and V. V. Meriakri for helpful discussion of the work. Figures 6; references 15: 5 Russian, 10 Western.

USSR

UDC 621.372.826:621.315.61

RESONANT REFLECTION IN CORRUGATED SLAB WAVEGUIDES WITH MONOTONIC LENGTHWISE DELAY VARIATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1297-1298 manuscript received 14 Oct 76

GUDZENKO, A. I.

[Abstract] An analysis is made of the problem of electric field distribution with respect to length in a planar waveguide with periodic modulation of one or more dielectric interfaces in the vicinity of the first resonance when the mode index is a monotonic function of length. The simplest case of a cosine-wave corrugation is considered in which the distribution of the electric field along the waveguide corresponds in a first approximation to solution of a Mathieu-Hill system. It is shown that the band of resonant reflection can be expanded with a monotonic law of change in delay lengthwise of a periodic structure. Figures 2, references: 4 Russian.

USSR

A COMMENT ON THE ARTICLE 'CALCULATING THE PHASE CONSTANT AND ATTENUATION FACTOR OF ELECTROMAGNETIC WAVES IN A CIRCULAR CORRUGATED WAVEGUIDE'

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1109-1110 manuscript received 12 May 77

AL'KHOVSKIY, E. A., IL'INSKIY, A. S. and TROSHIN, G. I.

[Abstract] A correction to an article published by the authors in "Radiotekhnika i elektronika," Vol 20, No 11, 1975, p 2250. The numerical results

given in that article for the attenuation factor of the HE_{11} wave were in error (Fig. 2 and the table). The error results from a miscalculation in the computer program. This paper gives the correct results of calculation of the attenuation factor of the HE_{11} wave as a function of the number of basis waves and spatial harmonics considered. The results are also confirmed by experimental data found by a resonant method. Figures 2; references: 1 Russian.

USSR UDC 621.372.413

USING A THERMOPHOSPHORESCENT SENSOR TO STUDY THE FIELDS OF OPEN RESONATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 936-939
manuscript received 8 Aug 77

VINOGRADOV, YE. A., IRISOVA, N. A., LAZAREV, A. A., MITROFANOVA, N. V., TIMOFEYEV, YU. P., FRIDMAN, S. A. and SHCHAYENKO, V. V.

[Abstract] Studies are done on a device for producing a visible image of the amplitude and phase patterns of open cavities in the millimeter and submillimeter wave bands. The technique involves using heat-sensitive phosphors to reveal the electromagnetic field density. A specially designed two-mirror cavity was used in which one mirror was the thermophosphorescent sensor [datchik], and the other mirror was a wire grating with period much less than a wavelength. The sensor is a sandwich structure with a base of lavsan film a few μm thick on which an aluminum layer was sputtered, followed by application of the thermophosphorescent film. The aluminum layer was about 500 Å thick, giving the resultant mirror a reflectivity of the order of 95 percent. An ultraviolet light source was used to stimulate uniform luminescence of the thermophosphorescent sensor. Microwave emission shaped by a horn radiator is focused into a beam by a heat lens to stimulate oscillations in the open cavity. Photographs are given of the field distribution for various modes of oscillation (TEM_{00}, TEM_{01}, TEM_{10}) on a wavelength of 4 mm. Photometry can be used to quantify the field distribution. The proposed device does not distort the field, and can be used for quality control and optimum alignment of cavity mirrors. Figures 4, references 9: 7 Russian, 2 Western.

USSR UDC 621.372.413-434.1

A TUNABLE OPEN CAVITY WITH CYLINDRICAL MIRRORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1072-1075 manuscript received 31 Mar 76

SUSHKIN, V. N.

[Abstract] When energy is coupled out through a central slit parallel to the generatrix in one of the cylindrical mirrors in an optical cavity with perpendicular mirror axes, a change in the curvature of the opposite mirror only changes the field along the coupling slit without changing the coupling factor. In this arrangement, tuning requires changing the configuration of the mirror with the slit. In this paper an investigation is made of the properties of a two-dimensional cavity with a cylindrical mirror having upper and lower halves which are deflected through a certain angle without changing the curvature of the mirror itself. A procedure is outlined for finding the optimum configuration of the proposed type of cavity. Application of this technique gives a diffraction efficiency of 80 percent for a cavity with optimum configurations. The error in determination of diffraction losses does not exceed 5 percent. The use of cavities of the proposed type increases the volume of the highest-Q mode over that of conventional configurations, as well as increasing the diffraction efficiency, and also enables the use of configurations with a low coupling factor having fairly large external apertures and mirrors with a radius of curvature that is not too great (about 20 percent of the length of the cavity). Figures 3; references 9: 7 Russian, 2 Western.

USSR UDC 621.374.22.029.64

FORMATION OF NANOSECOND MICROWAVE PULSES BASED ON FERROMAGNETIC RESONANCE UNDER CONDITIONS OF ALTERNATING MAGNETIZATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1279-1284 manuscript received 1 Apr 77

KUTS, P. S. and MEL'NIK, V. S.

[Abstract] A nanosecond microwave pulse shaper can be made on the basis of pulsed amplification of microwaves. The effect results from subjecting a magnetized ferrite to alternating magnetic fields on two frequencies: a transverse microwave field that excites ferromagnetic resonance, and a longitudinal rf field that produces harmonic modulation of the natural frequency of precession of the magnetic moments of the ferrite medium. It is

shown that microwave field amplification pulses can arise and be sustained if the frequency of the magnetizing field is of the order of T_2^{-1} (where T_2 is the relaxation time of transverse magnetization of the ferrite), the amplitude is of the order of half the width of the resonant absorption band or more, and resonant mismatch is of the order of $\mu_0|\gamma|h_{0m}$ or less, where μ_0 is the permeability of vacuum, γ is the gyromagnetic ratio of the electrons and h_{0m} is the amplitude of the magnetizing field. Nanosecond pulses are produced by processing the FMR microwave signal in a control device of balance type based on semiconductor technology. The output microwave pulses have controllable duration: a reduction in pulse duration from 100 to 65 ns is accompanied by a reduction in power from 2.7 to 0.7 mW. The pulse duration can be reduced to less than 10 ns with a recurrence rate of tens of MHz by using ferrites with resonant absorption bandwidth of the order of 1600 A/m. Figures 3; references: 11 Russian.

HPR

THE DENSITY OF MASTER-PATTERN FILMS FOR PRINTED CIRCUIT BOARDS

Budapest FINOMMECHANIKA-MIKROTECHNIKA in Hungarian Vol 17 No 6, Jun 78
pp 172-174

TOTH, ENDRE, associate professor, Department of Electronic Technology, BME
[Budapest Technical University]

[Abstract] In his paper delivered at the 15 September 1977 Component Conference sponsored by the Scientific Association for Communications Technology, held at Szekesfehervar, the author reported that a survey indicated that the density of master-pattern films for printed circuit boards is often non-uniform, mostly varying from one side to the other with the center having a density midway between the two side densities. It is likely that this defect is caused by the developing process, which is usually a manual one. Automatic development is likely to eliminate it. Remedy may also be obtained by immersing the film before development in a solution of wetting agent to prevent air bubbles from adhering to the film surface. Defects in the films may be identified and localized with the aid of microdensitometers such as the Joyce Automatic Recording Microdensitometer, Model MK III.C. This instrument helps to screen out defective films. The use of diazo-type films has many advantages: they need no darkroom, they permit positive copies to be made from positive film, and they are easier to emplace than silver halide films. It is said that diazo-type films tend to age. However, the author exposed several film samples 500 times with a Minitranex at Speed 9, and found no evidence of aging. Figures 10.

USSR UDC 621.3.066.6

PROPERTIES OF A JOSEPHSON JUNCTION IN A WIDE-BAND EXTERNAL SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1061-1071 manuscript received 10 Aug 77

ZAVALEYEV, V. P. and LIKHAREV, K. K.

[Abstract] An investigation is made of the characteristics of a superconductive weak-link connected in a wide-band external electrodynamic circuit. This is an intermediate case between the limiting cases of very high and very low impedances of the external system. Introduction of a wide-band external circuit partially shunts the radiation caused by the Josephson effect, whereas an autonomous mode is realized on low frequencies. This shunting leads to an unstable falling segment on the current-voltage characteristic of the weak-link where the differential resistance becomes negative. The differential resistance of the junction diverges at the boundaries of this segment, resulting in singularities in several characteristics. For this reason, particular attention must be given to the behavior of characteristics in calculating wide-band devices with Josephson junctions as the operating point approaches the ends of the falling section. The authors thank L. S. Kuz'min, V. V. Migulin and V. K. Semenov for discussing the work. Figures 2; references 13: 8 Russian; 5 Western.

USSR UDC 621.396.69.029.64.001.5

LIMITING CHARACTERISTICS OF SOME WIDE-BAND DEVICES WITH JOSEPHSON JUNCTIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1268-1278 manuscript received 10 Aug 77

ZAVALEYEV, V. P. and LIKHAREV, K. K.

[Abstract] Very high characteristics have been attained in a number of microwave receivers with superconductive weak link junctions. In this paper an examination is made of the limiting noise characteristics of wide-band receivers with Josephson contacts that do not require external pumping: a self-pumped down-converter, and wide-band and selective detectors. The article is a continuation of a previous work by these authors ["Radiotekhnika i elektronika," Vol 23, No 5, 1978 p 1061] and uses the same notation. It is shown that the impedance matching parameter that optimizes the noise characteristics depends on the normalized background temperature for the wide-band detector, and on the normalized signal frequency for the self-pumped down converter and the selective detector. A table is given comparing the theoretical values of the characteristics of these receivers with the best

experimental data. The discrepancies between the theoretical and experimental values of the noise temperature and fluctuation sensitivity of these devices can be reduced by improving wide-band matching with the signal channel and reducing stray radiation incident on the weak link junction. The authors thank L. S. Kuz'min and Ye. S. Soldatov for discussing the work. Figures 3; references 19: 11 Russian; 8 Western.

USSR UDC 621.372.632.001.5

COEFFICIENTS OF FREQUENCY CONVERSION ON JOSEPHSON POINT CONTACTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1263-1267 manuscript received 30 Jul 76

KOVALENKO, A. S.

[Abstract] Weak-link junctions can be used for parametric frequency conversion. The earliest research on converters using this principle showed the extremely low noise temperature of up-converters, but so far these devices have remained insufficiently studied. In this paper, the author analyzes conditions for getting maximum frequency conversion coefficients on weak-link up-converters. It is shown that the feasibility of up-converters on a Josephson junction with self-pumping is very promising for amplification of low-frequency signals. The maximum conversion coefficient in this case is attained when the signal is taken off on a combination frequency close to the characteristic frequency of the junction when bias currents are low, and is proportional to the ratio of the characteristic frequency of the junction and the signal frequency. The author thanks V. V. Migulin for discussion of the work. Figures 3; references 6: 4 Russian; 2 Western.

USSR UDC 621.313.013:621.59.001.24

COMPUTER-AIDED ELECTROMAGNETIC DESIGN OF CRYOGENIC ELECTRIC MACHINES

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 78 pp 47-52

NAKHAMKIN, A. M., ROZENKNOP, V. D., engineers, RUBINRAUT, A. M., candidate in technical sciences

[Abstract] The most essential distinguishing features of a cryogenic electric machine are the superconductor winding, the absence of steel for guiding

and concentrating the magnetic field within the inductor zone, the presence of an external electromagnetic shield for magnifying the magnetic field and preventing leakage, and the presence of an internal cryostat shell with a thermal shield inside where eddy currents are induced under asymmetric operating conditions. A performance and design analysis of such a machine requires that the magnetic field of the excitation winding be known. Because of the absence of an iron core, this field is one with an axially varying radial profile. The three-dimensional distribution of the magnetic field is calculated here on the basis of a mathematical model which takes into account the actual winding geometry and saturation of the ferromagnetic shield, but disregards eddy currents in this laminated shield as well as in the end plates and disregards hysteresis in all core laminations. The problem reduces to a Fredholm nonlinear integral equation of the second kind, which can only be solved numerically by successive linear approximations. The results obtained with the aid of a computer for a cryoturbogenerator with an excitation current of 70 A agree closely with experimental data. Figures 6; references: 7 Russian.

USSR UDC 621.317.794:621.391.82

INVESTIGATION OF LOW-FREQUENCY NOISE OF A SUPERCONDUCTIVE BOLOMETER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1051-1060 manuscript received 26 Oct 76

ZAYTSEV, G. A. and KH EBTOV, I. A.

[Abstract] Low-frequency noises were studied in high-speed superconductive bolometers in which the sensing element is a binary Pb + Sn film sputtered on a sapphire base in direct contact with liquid He I, liquid He II and helium vapor. Excess noise was observed on frequencies of 1-400 Hz with spectrum $\overline{u^2} \propto 1/f^3$. In the case of low bias current, the noise is proportional to the current and the slope; as the current increases, the noise becomes a nonlinear function of current with behavior $\sqrt{u^2} \propto I^{(2-3)}$. The noise level depends on the density of the Joule power, or of the power of the radiation incident on the bolometer. With transition of the helium to the superfluid state, the noise drops abruptly by several orders of magnitude. It is shown that in He I the noise is caused by temperature fluctuations which arise because of bubbling boiling of the helium: at low currents in the helium reservoir, and at high currents on the sensing element itself. It is suggested that the temperature fluctuations in He II may be caused by destruction of the film of superfluid helium on the walls of the cryostat. The influence that excess noise has on the threshold sensitivity of the bolometers is estimated with consideration of measurements of the coefficients of heat losses and the frequency responses. The authors thank N. A. Pankratov for continued interest in the work. Figures 9; references 12: 5 Russian; 7 Western.

PPR

A SPECTRUM ANALYZER WITH AN ACOUSTIC SURFACE WAVE

Warsaw ELEKTRONIKA in Polish Vol 19 No 3, Mar 78 pp 106-107

DANICKI, EUGENIUSZ; FILIPIAK, JERZY and OREZIAK, MAREK, Military Engineering Academy, Warsaw

[Abstract] A spectrum analyzer has been proposed which offers the possibility of signal processing by means of surface waves. Pulse compression with linear frequency modulation is effected by means of ultrasonic surface waves, with a chirp generated as the complex pulse response of an interdigital filter with few electrodes and transmitted to a filter with a reciprocal phase characteristic. The principle of this method has been demonstrated both analytically and experimentally. The experimental apparatus included a signal generator, a nanosecond pulse converter, a dispersion converter, a symmetric mixer, and a wideband converter. The difference-frequency signal produced by the mixer corresponded to an inversion of the dispersion signal and to a shift of the frequency band. The dispersion converter effected a Fourier analysis, in this case a pulse compression, with the pulse delay after compression being linearly dependent on the frequency of the generator signal. The output signal level peaked at some frequency, depending on the transfer characteristics of the amplifier, the mixer, the dispersion converter, and the wideband converter. This device can also be adapted for phase analysis or band filtration of a signal. Figures 4; references 4: 2 Polish, 2 Western.

USSR UDC 537.52.4.001

ELECTRICAL DISCHARGE IN LONG AIR GAPS WITH SLIGHT NON-UNIFORMITY OF ELECTRICAL FIELD

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian No 2, Mar-Apr 78 pp 99-106 manuscript received 3 Sept 76

BAZELYAN, E. M., LEVITOV, V. I., BURMISTROV, M. V. and VOLKOVA, O. V., Moscow

[Abstract] Investigations are made of the growth of a discharge in a sphere-plane air gap. The experiment was conducted for a globe with a radius of 12.5, 25 and 50 cm. A GIN [pulse voltage generator] -- 3.5 MV was used as a source of test voltage which formed a positive voltage pulse with a duration of the front of 5, 30, and 350 ks. In all cases the duration of the pulse was not less than 3500 mks. The degree of inhomogeneity of the electrical field was 1.3-8.6. It is noted that the structure of the leader and its qualitative characteristics differ from that observed in fields with a very high degree of nonuniformity of the electrical field. The degree of nonuniformity of an electrical field is characterized by the coefficient of nonuniformity, equal to the ratio of the maximum and average intensity in the discharge gap, $m = E_{max}/E_{aver}$. It is shown that the leader mechanism of the growth of a discharge in long air gaps at normal atmospheric pressure is maintained with a small degree of nonuniformity of the electrical field (m = 1.3). The initial phase of the leader process deteriorates in electrical fields with a coefficient on nonuniformity less than $m_{critical} = 6--7$. The volt-second characteristic of the discharge gaps with $m \leq m_{critical}$ does not have a minimum. The stored voltage of long air gaps with $m \leq m_{critical}$ is equal to the initial voltage of a stationary corona. Figures 6; tables 2; references 12: 6 Russian; 6 Western.

USSR UDC 537.874.4

SCATTERING OF ELECTROMAGNETIC WAVES BY ACOUSTIC FORMATIONS OF THE ATMOSPHERE IN THE FIELD OF A POINT SOURCE OF SOUND WITH EXTENDED SPECTRUM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1285-1288 manuscript received 1 Sep 76

KUZNETSOV, B. T.

[Abstract] In a previous paper by this author ["Radiotekhnika i elektronika," Vol 21, No 12, 1976 p 2623] an analysis was made of scattering of

electromagnetic waves by acoustic formations in the air in the vicinity of a moving harmonic point source of sound in the scalar approximation. Now the vector nature of the electromagnetic waves is considered for fields with non-zero spectral width. Expressions are given for the vector of the electric field strength of a radio wave propagating in a medium perturbed by a sound wave, and for the field of the scattered radio wave. It is shown that the sound wave and the radio wave can be represented as a superposition of harmonic waveforms. The equation for the scattered radio wave is solved, and an expression is derived for the components of the scattered field in the Fraunhofer zone. Two cases are considered: 1) The vector of the electric field strength of the incident radio wave is normal to the plane of incidence; and 2) The electric field vector lies in the plane of incidence. The effective reflecting surface s of the region occupied by the sound field is determined for each case. Curves are given for s as a function of the scattering angle for both polarizations, taking the frequency of the sound wave as the parameter. With a change in frequency from 4 to 8 kHz, s remains constant for the same scattering angle. The wavelength of the probing radio signal must be changed in accordance with the Bragg ratio when there is a change in acoustic frequency and scattering angle. Figures 2; references: 6 Russian.

USSR UDC 538.54.001

DISCHARGE OF CAPACITIVE ENERGY STORAGE DEVICE INTO MOBILE SYSTEM OF BIFILAR CONDUCTORS

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian
No 2, Mar-Apr 1978 pp 92-98 manuscript received 1 Apr 77

BALTAKHANOV, A. M. and BONDALETOV, V. N., Istra

[Abstract] The paper investigates the electromagnetic and electromechanical transient processes during acceleration of conductors in a pulsed magnetic field produced by the current from the discharge of a capacitive energy storage device into a mobile system of bifilar conductors. The process in the bifilar is described by methods from the theory of an electromagnetic field, and the exterior circuit (capacitor bank, supply main, air gap between plates of bifilar), which assigns boundary conditions at the surface of the plates, is represented by an equivalent circuit according to the theory of electrical networks. The solution obtained makes it possible to take into account the penetration of the pulsed magnetic field into the conductor, and the change of velocity and the distance between conductors during their acceleration. Figures 4; tables 1; references: 8 Russian.

USSR UDC 538.574.6

ASYMPTOTIC METHOD OF CALCULATING THE WAVE DIFFRACTION FIELDS AT CONVEX SOLIDS OF REVOLUTION

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 7, Jul 78 pp 1011-1018
manuscript received 15 Mar 77

ORLOV, YU. I. and ORLOVA, N. S., Moscow Power Engineering Institute

[Abstract] Diffraction of a plane electromagnetic wave at an ideally conducting solid of revolution is considered as a three-dimensional problem. The smooth convex surface of such a solid conductor is described by a parametric equation in cylindrical coordinates and the density of the electric current, with a meridional and an azimuthal component, induced by the incident field is sought in an asymptotic integral form. The steady-phase method is employed for evaluating the amplitude function under the integral, on the premise that far from a caustic surface of a creeping wave this representation yields the same result as the quasi-ray method. In various regions such as the umbra and the penumbras, moreover, this representation is found to asymptotically approach those based on geometrical optics. Figures 1; references 15: 12 Russian; 3 Western.

USSR UDC 621.371.25

EXCITATION OF THE EARTH-IONOSPHERE WAVEGUIDE WITH LOW-FREQUENCY SOURCES LOCATED IN THE NONHOMOGENEOUS IONOSPHERE

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 7, Jul 78 pp 938-944
manuscript received 3 Mar 77

KOTIK, D. S., POLYAKOV, S. V. and YASHNOV, V. A., Scientific-Research Institute of Radiophysics

[Abstract] Earlier experiments at Gor'kiy in 1973-74 have shown that an amplitude-modulated signal from a powerful short-wave transmitter can, upon impinging on the lower boundary of the ionosphere, generate electromagnetic radiation at the modulation frequency. Here the earth-ionosphere channel is regarded as a model waveguide with a nonhomogeneous upper boundary. The ionosphere is assumed to be a plane-laminar isotropic medium whose refractive index varies exponentially with altitude. The electromagnetic field radiated from a vertical or a horizontal elementary dipole inside this waveguide is analyzed in Cartesian coordinates. Solving the wave equation yields the dependence of the electric field intensity at the earth surface on the altitude and the orientation of the source. Near the lower boundary

of the ionosphere, accordingly, the fundamental mode is excited most effectively by a vertical dipole. At higher altitudes, however, a vertical dipole becomes less effective and, above some critical altitude where they are both equally effective, a horizontal dipole becomes more effective. Figures 3; references 12: 8 Russian; 5 Western.

USSR UDC 621.371.334

COEFFICIENTS CHARACTERIZING THE DIFFRACTION OF SPHERICAL AND CYLINDRICAL WAVES AT A FIN

Moscow RADIOTEKHNIKA in Russian Vol 33 No 6, Jun 78 pp 97-99 manuscript received 29 Mar 77

PIMENOV, YU. V. and SALAH, A. K. (male graduate student from Iraq at the Moscow Order of the Red Banner of Labor Electrotechnical Institute of Communication)

[Abstract] The diffraction coefficients at a fin of a body are calculated by asymptotic expansions for the special case where the equivalent wedge with both planes tangent to the body surface at the point of diffraction degenerates into a half-plane. The calculations are based on the rigorous solution to the problem of diffraction of spherical electromagnetic waves at an ideally conducting half-plane. The formulas for these coefficients are correct only in the case of relatively large radii of fin curvature at the point of diffraction. With appropriate substitutions, these formulas can be modified for diffraction of cylindrical waves. Figures 2; references 3: 1 Russian; 2 Western.

USSR UDC 621.371.342.029.55

RESULTS OF AN EXPERIMENTAL STUDY OF RADIO WAVE PROPAGATION ON A FREQUENCY OF 19 GHz

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1129-1134 manuscript received 1 Feb 77

LARIN, YE. A. and SERGIYENKO, E. K.

[Abstract] The paper gives the results of measurements of radio wave attenuation in the summer months in rain and with multibeam propagation. The measurement equipment had an emission frequency of 19.1 GHz at a power of 300 mW

with horizontal polarization. The transmitting and receiving antennas were each made up of a parabolic reflector and waveguide radiator and had a gain of 40.5 dB. The superhet receiver sensitivity was 133 dBW. The IF passband of the receiver was 5 MHZ and the passband on the modulation frequency was about 50 Hz. The time constant of the recording equipment was less than 1 s. and the error was within 1.5 dB in measurements of the absolute signal level. The line-of-sight transmission path was 35 km long over various kinds of terrain typical of the European USSR. It is shown that the stability of radio reception under the given conditions in the 19 GHz band is almost completely determined by falling rain. The duration of deep fading of radio waves in rain is considerably greater than that of fading because of multibeam propagation. Attenuation of radio waves on the given transmission path during summer does not exceed 40 dB for 99.9 percent of the time. The rate of deep fading during rain is slower on the average than in the case of multibeam propagation. The authors thank V. M. Burmistrov, T. T. Vasina and L. V. Kazantseva for assisting with the experiments and with analysis of the materials. Figures 8; reference: 1 Russian.

USSR UDC 527.533.2.001.5

KINETIC ELECTRON EMISSION WHEN HYDROGEN IONS WITH ENERGY OF 0.3-30 keV ARE SHOT THROUGH CONDUCTIVE AND DIELECTRIC FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1251-1256 manuscript received 5 Apr 77

LIKHTENSHTEYN, V. KH., SHABEL'NIKOVA, A. E. and YASNOPOL'SKIY, N. L.

[Abstract] The paper gives the text of a report delivered to the Sixteenth All-Union Conference on Emission Electronics held in Makhachkala, 8-11 September 1976. An experimental study was done on the main characteristics of electron emission when H^+ hydrogen ions with an energy of 0.3-30 keV are shot through thin polycrystal films of carbon, nickel, silver and gold, and also through dielectric layers of magnesium oxide and cesium chloride on conductive substrates. The paper gives the results of these studies for three materials of practical importance as emitters -- nickel, carbon and cesium chloride. It is found that emission begins at a certain threshold energy (200-250 eV for carbon foil about 50 Å thick), and that the coefficient of electron emission γ increases monotonically with an increase in the ion energy E_0 in the energy range investigated, reaching maximum values of 3-5 for carbon and nickel films, and 7-10 for dense layers of CsCl. The yield of secondary electrons is determined by the losses of energy of fast particles in the zone of electron output, and also by the relations between emitter thickness, the mean free path of the ions and the depth of the zone of electron output. When the ion energy is held constant, there is an optimum emitter thickness corresponding to maximum secondary electron yield. At a certain ion energy that depends on film thickness and material, the emission on the transmission side exceeds that on the reflection side, which is apparently caused by the considerable part played by anisotropic mechanisms in processes of excitation and injection of the secondary electrons into vacuum. As an example of practical use of the effect, the authors consider a "transmission" type of atomic particle detector. Thanks are expressed to I. L. Golovin for support and interest in the work, and also to V. S. Nikolayenko for developing the technique and making the carbon emitters. Figures 6; references 10: 8 Russian; 2 Western.

USSR UDC 621.383.633.24.001.5

CONCERNING THE INFLUENCE THAT A MAGNETIC FIELD HAS ON THE PARAMETERS OF THE MINIMUM POTENTIAL IN A DIODE WITH CROSSED FIELDS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1317-1319 manuscript received 13 Sep 76

KULIKOV, M. N. and SHCHEGOLEVA, A. N.

[Abstract] An estimate is made of the influence that a magnetic field has on the parameters of the minimum potential in a flat, infinitely extended M-type diode. Curves are given for the normalized coordinate and normalized potential at the cathode and the anode current density as functions of the magnetic field for a diode with given distance between electrodes (1 mm), anode voltage (500 V) and emission current density (3.2 A/cm^2). The results show that as the magnetic field induction increases while the anode potential is held constant, there is a reduction in anode current density, the minimum potential becomes deeper, and the plane of the minimum potential moves away toward the anode. The mechanism responsible for this behavior is explained in terms of the trajectories of individual electrons leaving the cathode. It is found that as the magnetic field induction increases, the symmetric behavior of the trajectories is disrupted and more electrons begin to return to the cathode because of the "twisting" action of the Lorentz force. Figures 2; references 7: 2 Russian; 5 Western.

USSR UDC 621.385.64

AN EIGHT-MILLIMETER MAGNETRON TRIODE WITH LENS OPTICS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1030-1038 manuscript received 26 Jul 77

LEVIN, G. YA., MIKHAYLOV, V. I., TERYOKHIN, S. N. and LOGVINENKO, A. I.

[Abstract] Experimental and theoretical studies are done on a magnetron triode with lens optics in the 8-mm band. A simplified model of the device is analyzed in order to determine the necessary geometry of the interaction space and controlling electrodes, and to establish some of the laws that determine the properties and parameters of the modulation characteristics of the device. The model is based on the assumption that a change in voltage across the lens changes the dimensions of the region accessible to the electrons for entering the interaction space, and predetermines the charge, so that it is possible to influence that electron flux effectively coupled to the rf field (which is concentrated close to the slow-wave structure in a

surface-wave magnetron); this changes the octput power and maximum electronic efficiency; as well as the anode current. It is shown that 20 percent amplitude modulation with respect to power can be realized in the magnetron triode with lens optics with frequency deviation of the order of 20 MHz or less. It was found in studies of a number of magnetrons that there is no lag in control of the amplitude of waveforms with modulation up to frequencies of the order of 10^7 Hz. Experiments with pulse modulation using a miniature type G5-15 pulse generator with pulse duration as short as 100 ns showed no inertial effects leading to broadening of the spectrum of the generated signals. The authors thank V. I. Vigdorchik for continued interest in the work and constructive criticism. Figures 7, references 11: 10 Russian; 1 Western.

USSR UDC 621.385.6

GROUPING OF ELECTRON FLUX WITH ELECTRON VELOCITY SCATTERING IN A GYROKLYSTRON WITH AN INHOMOGENEOUS MAGNETIC IIELD

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 6, 1978 pp 896-901 manuscript received 11 Feb 77

KEYER, A. P.

[Abstract] As shown in the literature, the mechanisms for grouping of electron flux in a gyroklystron has a far-reaching analogy with the mechanism of grouping in Type "O" klystrons. In multiple-cavity klystrons efficient grouping is attained in a regime of maximum efficiency. However, in gyroklystrons realization of this regime is difficult because it is necessary to provide for each high-velocity group of electrons, inasmuch as electron velocity scattering in the flux is great. The present paper considers the possibility of achieving a grouping regime corresponding to maximum efficiency, with the aid of a slightly nonhomogeneous static magnetic field in a three-cavity gyroklystron. Fulfillment of the condition of a slightly relativistic approximation is taken into consideration. The percent modulation of the electron flux and the amplitude of the high-frequency field in buncher resonators is assumed to be small. This makes it possible to confine to the solution of the equations of the motion of electrons, terms proportional to the first degree of the amplitude of the high-frequency field. The results of the analysis of a gyroklystron conducted in the work make it possible to conclude that in a nonhomogeneous static magnetic field it is possible to accomplish grouping of a flux with electron velocity scattering, corresponding to a regime of maximum efficiency. In addition there is a possibility of effectively controlling the phase displacement of the entry of electron beam bunches into an output resonator which is necessary for optimum

withdrawal of energy from the flux. The example presented of a calculation of the smoothed profile of a magnetic field shows that in preliminary evaluations of grouping of the flux it is possible to use a piecewise-homogeneous field with a subsequent approximation of it by the method of least squares. The author thanks V. T. Ovcharov for supporting the work, and A. V. Gaponov and V. K. Yulpatov for a number of helpful comments. Figures 6; references 9: 8 Russian; 1 Western.

USSR UDC 621.385.632.001.2

LINEAR WAVE THEORY OF TRAVELING-WAVE TUBE NEAR THE PASSBAND LIMIT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1103-1105 manuscript received 8 Jul 76

SOLNTSEV, V. A. and KRAVCHENKO, N. P.

[Abstract] A new approach is proposed for studying beam interaction with the field in slow-wave cavity systems in a traveling-wave tube with periodic structure. The procedure is based on the theory of excitation of slow-wave systems, and provides a simple transition from the theory of a TWT with smooth systems to the theory of a TWT with periodic systems via generalization of a number of known parameters, in particular the coupling resistance. The basic principle of the theory is that two space harmonics of the field of the system can effectively interact with the electron beam close to the boundary of the passband. The specific case of a system with positive dispersion of the fundamental wave close to the shortwave passband limit is considered. It is shown that the proposed generalization of the linear wave theory to TWT's with periodic structure of the slow-wave guides is valid both within the passband of the device and outside of this passband. Figures 2; references: 10 Russian.

USSR

UDC 535.31

METHOD OF DETERMINING THE DIMENSIONS OF A SOURCE ACCORDING TO THE DIFFRACTION IMAGE ON THE BASIS OF A CHEBYSHEV APPROXIMATION

Gor'kiy IZV. VUZ: RADIOFIZIKA in Russian Vol 21 No 6, 1978 pp 888-895
manuscript received 20 Dec 76; after revision, 12 Oct 77

RUBENYOK, A., Ukrainian SSR Academy of Sciences, Radio Engineering Institute

[Abstract] In order to obtain an estimate of the extension of a finite input according to the response of a linear system measured with addi ive noise, a simpler, cleaner and more universal procedure than that shown in the literature is proposed. The proposed procedure is based on the methods of a Chebyshev approximation and is intended for accomplishment on an electronic computer. The value of the extension which assures a minimum error of the approximation is considered to be true. The method and the results of its application are described in detail. In order to obtain a reliable estimate it is necessary to expend on the order of 5 minutes calculating time on a BESM-6 electronic computer. The proposed method can be used without significant changes for one-dimensional objects with a complex spectrum, which also specifically makes it possible to determine, together with the size, other parameters, e.g., the position of the center and the amplitude of the harmonic. Figures 3; tables 7; references 6: 5 Russian; 1 Western.

USSR

UDC 621.317

AUTOMATED BENCH FOR CHECKING PARAMETERS OF LINEAR MICROCIRCUITS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 78 pp 43-45

BOGORODITSKIY, A. A., SHADRIN, M. P., candidates in technical sciences,
OKAT'YEV, N. A., OSOBOVA, T. I., SUPONIN, B. A., SHISHKOV, YU. V. and
SHUNSKIY, L. D., engineers

[Abstract] The development and industrial mastering of linear integrated circuits (LIS) for special purposes and the wide application of circuits for general use urgently requires that work be conducted on meteorological provisions of the technology of their production and use. The present paper describes a measurer of the parameters of operational amplifiers (OU) intended for input checking by enterprise-consumers or for output checking at enterprise-consumers which have an average small-scale volume of output of linear microcircuits of the class mentioned. The measurers is a programmed automated bench made on the basis of the principles of utilizing and unified

joining of individual equipment modules. The metrological characteristics of the bench are presented in a table, and an exterior photograph of the bench is shown. The dimensions of the bench (without the digital printer) are 485 x 545 x 1135 mm. At present the Penzenskiy affiliate of VNITIpribor (All-Union Scientific-Research Technological Institute of Instrument Construction) has developed and entered into production prototypes of the bench. Figures 3; tables 1; references: 3 Russian.

USSR UDC 621.317.42

ON A METHOD OF SUPPRESSING HIGHER HARMONIC COMPONENTS IN THE OUTPUT SIGNAL OF A FERRITE CORE

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 3, 1978 pp 39-42 manuscript received 28 Apr 77

YUDIN , V. V., Rybinsk Institute of Aviation Technology

[Abstract] An examination is made of the operation of a magnetic core with input, output, reference and demagnetizing windings, and it is shown that higher harmonics in the output signal can be suppressed by connecting a compensating winding through the core between the demagnetizing and output windings. The additional winding is in opposition to the demagnetizing winding with one side connected directly to the opposite side of the demagnetizing winding, while the other side of the compensating winding is connected to the remaining side of the demagnetizing winding through a resistor and capacitor in series. The alternating component isolated by the capacitor compensates the component of the magnetic flux because of the action of current pulsations in the demagnetizing winding, thus reducing distortions of the output signal. The proposed circuit is analyzed, and experimental results are given. The results show that it is feasible to use an additional compensating winding in controlled magnetic cores when the output signal must meet strict waveform requirements. The paper was recommended by the Radio Engineering Department. Figures 2; references: 3 Russian.

USSR UDC 621.317.77

AN INSTRUMENT FOR MEASURING AMPLITUDE-PHASE RATIOS OF MICROWAVE SIGNALS WITH A FREQUENCY CARRIER

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 3, 1978 pp 5-10
manuscript received 16 Aug 77

VIL'KOTSKIY, M. A., GRINCHUK, A. P., ZIN'KEVICH, A. V. and KNYSH, V. P.,
Belorussian State University imeni V. I. Lenin

[Abstract] Techniques and devices for measuring the phases of microwave signals can be divided into two classes: systems in which space beating of waveforms is used to convert phase relations to amplitude ratios, and systems with time beating which usually measure phase ratios of low-frequency signals produced by frequency conversion of the initial microwave signals. Phase meters of the first class are simple in design, but low in sensitivity and narrow in dynamic range. The sensitivity and dynamic range are better in the second class, but these are narrow-band instruments and complicated in design. This article describes a mixrowave ampliphasometer that has the advantages of sensitivity and wide dynamic range of the second class, and does not use devices for frequency conversion and shifting. The device contains two balanced mixers, one of which is directly connected to an adder, while the other is connected to the same adder through a phase shifter that shifts the reference signal through 90° on the modulation frequency. The adder output is connected to a low-frequency phase meter and an S-meter. The low-frequency phase meter is a two-channel device with clipper amplifiers and shapers in each channel. The signal phase is converted to the delay time between two successive pulses. Readout is on a ChZ-35 frequency meter with digital display in degrees. The signal strength is also digital in volts on the F4830 voltmeter. Working band is 8.9-9.8 GHz, dynamic range of input signals -- 40 dB, sensitivity -- $5 \cdot 10^{-9}$ W/cm^2. Errors -- 2 percent in amplitude and 3° in phase. The paper was recommended by the Department of Physics and Microwave Electronics. Figures 4; references: 9 Russian.

PPR UDC 621.317.328

MEASUREMENT OF THE POWER DENSITY IN THE NEAR-FIELD ZONE

Warsaw ARCHIWUM ELEKTROTEKHNIKI in Polish Vol 26 No 4, Oct-Dec 78 pp 797-812
manuscript received 14 Mar 76

BABIJ, TADEUSZ M. and TRZASKA, HUBERT, Department of Antennas and Transmission Radio Engineering, Wrocaw Polytechnic Institute

[Abstract] For accurate measurements of the power density in the near-field zone, at frequencies below 300 MHz, three systems of probes [datchik] have been developed by the authors which simultaneously pick up the electric and the magnetic field components. In the first variant an E/H pair of loop antennas with identical frequency characteristics is mounted in each of the three orthogonal planes so as to eliminate distortions of a spherical radiation pattern of the magnetic field component, with the main drawback here being the excessively large size. In the next variant, reduced in size, a triply quadrant antenna consists of three mutually orthogonal loops with pairwise common arms. In the last version an extra element is added to form three more quadrant antennas with the respective arms of the triply quadrant antenna so that also a spherical radiation pattern of the electric field component will result. A remaining drawback of this modified triply quadrant antenna is its different responses to changes in the polarization of the electric field and of the magnetic field respectively. Figures 8; references 23: 7 Polish; 1 Russian; 15 Western.

USSR UDC 621.317.725.681.325

AN ERROR CORRECTION METHOD IN INTEGRATING DIGITAL MEASUREMENT DEVICES

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 4, 1978 pp 14-19
manuscript received 16 Aug 77

BARAN, YE. D., Novosibirsk Electrical Engineering Institute

[Abstract] An algorithm is proposed for automatic error correction in an integrating digital voltmeter based on a linear voltage-to-frequency converter without a common feedback circuit. First the input voltage is measured and zero drift is corrected. The correction result contains only a multiplicative error component determined by instability of the slope of the transfer characteristic of the voltage-to-frequency converter. This error component is reduced by a "double" integration technique involving comparison of the measured, reference and bias voltages. The number of cycles necessary for attaining a predetermined minimum error is shown to be less than 15-17 for a relative error of 10^{-5} or less. This figure is improved with a reduction in the measured voltage. Because the absolute error retains the same sign throughout the measurement procedure, an ordinary adder can be used as the output register instead of a reversible counter. The algorithm is not critical to stability of characteristics of the analog part of the device, and the digital part is simple and uniform. It should be possible to develop microelectronic devices on the basis of the proposed technique. The paper was recommended by the Department of Information Measuring Techniques, Novosibirsk Electrical Engineering Institute. Figures 2; references: 5 Russian.

USSR UDC 621.382

JAMPROOF SYNCHRONOUS DETECTOR, USING MICROCIRCUIT ELEMENTS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1978 pp 40-41

MOGILEVSKIY, A. N., candidate in technical sciences, SLAVNYY, V. A., candidate in physico-mathematical sciences, SUBOCHEV, A. I. and ASTAF'YEV, P. N., engineers

[Abstract] The circuit is presented on a synchronous detector based on a synchronous filter, constructed with the use of integrated microcircuits. The detector consists of a low-frequency RC-filter made in the form of a series-connected resistor and two capacitors of identical capacitance, and a switch (transistor switch), which by turn periodically connects the

capacitors of the filter with a common conductor. The output signal is taken from the input terminal of the switch. The synchronous detector described is successfully used in units for recording weak spectral lines in the presence of a continuous background based on periodic scanning of a spectrum. Figures 2; references 4: 3 Russian; 1 Western.

GDR

A SIMPLE LABORATORY TEST SET FOR DIGITAL INTEGRATED CIRCUITS

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 27 No 5, 1978 pp 293-294

PILZ, ROLAND, Information Technology Section, Dresden Technical University

[Abstract] Digital integrated circuits of the D 10 series may be tested under output-side load with the test set described. The test information is simple to assemble; it can be accommodated on a 2-level circuit board 185 mm by 130 mm in size. It contains 20 circuits, including 9 D 172 circuits, plus a number of discrete components. There is a program card for each circuit to be tested; it contains the holder for the tested circuit plus an identical reference circuit. The instrument basically consists of subassemblies for timing-pulse generation, binary counting, programming, and evaluating. Selected outputs of the sample and the reference circuit are connected as the program card is plugged in. All possible combinations of the input variables are thus handled. The instrument performed satisfactorily in practical use, both in the laboratory and the factory. It may be expanded as desired by simply preparing additional program cards. A suitable simultaneous circuit may also be used instead of the reference circuits. The testing of selected sequential circuits (D 172, D 174, D 191) with the instrument is described in order to illustrate the procedures involved. Figures 5; references: 1 German.

USSR

UDC 620.179.1

DETERMINING THE EFFECTIVENESS OF WELDED AND SOLDERED SEAMS IN INTEGRATED-CIRCUIT STRUCTURES WITH THE AID OF A FOURIER HOLOGRAM

Kishinev DEFEKTOSKOPIYA in Russian No 5, Sep-Oct 78 pp 87-90 manuscript received in finished version, 26 Aug 77

DUBITSKIY, L. G. and ROZIN'KOV, N. S.

[Abstract] An effective method of inspecting welded and soldered connections in IC structures by comparison with a reference specimen is the use of a Fourier hologram. With a coherent light source and by correctional analysis, product samples and the reference specimen or images of both are compared here on the basis of their spatial spectra. A typical version of an instrument for this purpose includes a system of three biconvex lenses, with the transparency of a sample on a film immersed in a fluid behind the first lens and a filter behind the second lens. This filter, having a transmittivity proportional to the spatial complex-conjugate spectrum of the reference specimen, represents a Fourier hologram obtained according to A. vander Lugt by interaction of a reference wave with the Fourier image of the reference specimen. This method was tested, using x-rays, on IC structures with hermetic sealing and two kinds of defects in the latter: solder deficiency or solder spillover inside. An analysis of the results indicates a high sensitivity of the output signal to changes in the relative defect area and its independence of the defect type. Figures 5; references 5: 2 Russian, 3 Western.

USSR UDC 621.3.01

APPLICATION OF GENERALIZED FUNCTIONS TO THE INVESTIGATION OF TRANSIENT PROCESSES IN LINEAR ELECTRIC SYSTEMS WITH LUMPED CONSTANTS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 347-356 manuscript received 11 Aug 75

ZOROKHOVICH, ALEKSANDR YEFIMOVICH, dr in technical sciences, Professor, Moscow Institute of Railroad Transportation Engineers; and ROZENBERG, BORIS MARKOVICH, junior scientific worker, Moscow Institute of Railroad Transportation Engineers

[Abstract] A new method is proposed for studying transient processes in linear electric circuits with lumped constants with the use of generalized functions. The approach is based on using operators of generalized differentiation and integration to convert the solution from continuous functions to generalized functions. In place of initial differential or integrodifferential equations in continuous functions, these operators give algebraic equations in generalized functions, the equations, like the initial ones, being functions of time. The proposed method enables rigorous calculation of transient processes in any linear electric circuits with lumped parameters for any input actions, the final results being in generalized functions, which corresponds best to the dynamics of the circuits. Kirchhoff's first and second laws, and also Ohm's law in generalized functions are analogous in form to the same laws in complex form for a harmonic current circuit. Calculation of transient processes by the proposed method precludes the necessity for determining the constants of integration from the initial conditions. Figures 3; references 25: 22 Russian; 1 Czech; 1 Polish; 1 Western.

USSR UDC 621.3.018

ON EVALUATING THE PARAMETERS OF INDUCTIVE-CAPACITIVE THYRISTORIZED PULSE SHAPERS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 442-444 manuscript received 2 Nov 76

TYSHKO, VADIM ANATOL'YEVICH, candidate in technical sciences, assistance to Director in Scientific Work, AzNIETI [expansion unknown]; and POGUDIN, ARKADIY IVANOVICH, docent, Lipetsko Polytechnical Institute

[Abstract] The authors consider inductive-capacitive pulse shapers which are oscillators storing energy in a capacitor and discharging it through a

thyristor and pulse transformer into a load. A method is proposed for evaluating the parameters of such a shaper by taking the output pulse as equivalent to the inscribed square pulse with maximum area. It is shown that in this case the average value of the voltage across the load during the pulse action is practically equal to the amplitude of the equivalent inscribed square pulse. The proposed technique for evaluating the parameters of output pulses and the oscillatory tank circuit improves accuracy and simplifies the process of calculating the inductive-capacitive pulse shapers. Figures 4; references: 1 Russian.

USSR

USE OF SERIES K155 MICROCIRCUITS

Moscow RADIO in Russian No 5, 1978 pp 37-38

ALEKSEYEV, S., Moscow

[Abstract] The K155IYe6 and K155IYe7 reversible-counter IC's are described. These microcircuits have forward and reverse clock pulse inputs, a reset input, and also an input for presetting the counter to a number from 0 to 9 according to information entering four of the digit terminals. The sequence of operations is described for forward and reverse counting. A frequency divider circuit using these IC counters is considered. The maximum coefficient of division using K155IY36 microcircuits is 10^n, where n is the number of IC's. The corresponding maximum division factor with K155IYe7 counters is 16^n. Another microcircuit in this series is the K155IYe8, which contains a counter that divides the input frequency by 64, coincidence gates that isolate noncoincident pulses -- every second, every fourth, every eighth and so on -- and an OR gate that enables transmission of some or all of the isolated pulses to the output so that the output pulse frequency can be varied from 1/64 to 63/64 of the input pulse frequency. A circuit is shown in which two such IC's are cascaded to give from 1 to 4095 pulses at the output when 4096 pulses arrive at the input. Applications for these circuits are considered in electronic timepieces and in tone generators for electronic musical instruments. Figures 4.

USSR UDC 621.316.8-416

INSTRUMENT FOR MATCHING OF THIN-FILM ELEMENTS OF MICROCIRCUITS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1978 pp 45-46

CHERNOBROVKIN, D. I., candidate in technical sciences, MISHANIN, N. D., PIGANOV, M. N. and GONCHAROV, A. G., engineers

[Abstract] Contemporary methods for producing the thin-film elements of microcircuits do not assure the desired reproducibility and precision of their rated values. With the object of obtaining precision elements for measuring equipment, special technological operations are used, e.g., laser or two-electrode electric-spark methods of removing a specified part of the film. However, the effectiveness of these methods is insufficient. In the present paper a method is described for matching of thin-film elements of microcircuits, based on removing part of the film element by a free high-frequency torch [fakel'nyy] discharge, which is excited at the end of an electrode under a high-frequency potential from a high-frequency continuous wave oscillator. The advantage of the method in question is that only one electrode (the point of a metal needle) is used. Figures 3; tables 1; references 4: 2 Russian; 2 Western.

CZECHOSLOVAKIA

PROPERTIES AND PARAMETERS OF INTEGRATED CIRCUITS MDA2020 AND MDA2010

Prague SDELOVACI TECHNIKA in Czech Vol 26 No 4, Apr 78 pp 125-129

MACHALIK, LUDVIK; SLIZEK, RUDOLF, engineers

[Abstract] The high performance amplifiers MDA2020 and MDA2010 are produced by TESLA at Roznov and represent the third generation of integrated amplifiers produced by TESLA. The amplifiers operate at low frequencies and are suitable for low-frequency and high-frequency duties. The size of the silicon chip is 1.8 x 2.7 mm, encapsulated in a plastic material having 14 outlets arranged in four rows. The amplifiers are provided with heat protection safety circuits. Protective circuits for excessive voltage and high current flows are also supplied. The output of the semiconductor amplifiers of the MDA series is 20 W; all components of the units have been tested in experimental applications. The amplifiers require a supply of refrigeration media; without that they cannot be used. The design of the refrigeration unit must take into account all losses encountered by the system. Figures 16; tables 2; references 4: 1 Czech; 3 Western.

CZECHOSLOVAKIA

PROPERTIES OF OPERATIONAL AMPLIFIERS MAA741 AND MAA741C

Prague SDELOVACI TECHNIKA in Czech Vol 26 No 3, Mar 78 pp 82-86

HRUBY, FRANTISEK, engineer

[Abstract] Operational amplifiers MAA741 and MAA741C are produced by the firm TESLA at Roznov, and are designed as equivalents to the amplifiers µA741 and µA741C produced by the US firm Fairchild. TESLA started producing Types MAA 501-504 operational amplifiers in 1970 and later in 1975 produced Type MAA725. The circuits of the operational amplifiers consist of the input section, the second step, the last step, the prestress reference between 3 and 22 V, current loss 500 mW, max. diff. in input voltage ± 30V, and operating temperatures can vary between -55 to +125°C for the Type MAA741 and 0 to 70°C for the MAA741C Type. The minimum input resistance is 0.3, normal 3 Ohms. In the article several graphs of the following functions are shown: effect of current frequency on amplification; effect of phase delay on the frequency; effect of the frequency on the variation and the output voltage; effect of input current density on amplification; effect of the resistance of the circuit on changes in the output voltage; effect of temperature on the operating characteristics of the amplifier;

effect of the current frequency on the suppression of resonance signals. The amplifiers have excellent characteristics and are easily installed and thus can find many uses. Figures 27; tables 7; references 2: 1 Czech; 1 Western.

HPR

PACKAGING TECHNOLOGY OF INSULATOR-BASED HYBRID INTEGRATED CIRCUITS

Budapest FINOMMECHANIKA-MIKROTECHNIKA in Hungarian Vol 17 No 6, Jun 78 pp 178-186

Mrs. RECZEY, GUSZTAV, assistant professor, and RIPKA, GABOR, associate professor, Department of Electronic Technology, BME [Budapest Technical University]

[Abstract] The authors briefly describe the various packaging methods for integrated circuits and the criteria for selecting packaging methods for hybrid integrated circuits. Then they describe the packaging methods for insulator-based hybrid integrated circuits developed at the Department of Electronic Technology of BME. The pin-board sywtems used are made by contour etching on both sides from bronze panels by the solid photoresist (RISTON) method. The master patterns are cut in tenfold magnification from dual-layer Rubylith foil on a tape-controlled drawing machine. The control tape is made with the aid of the so-called Grafomaszk translation program. The various versions of packaging are described briefly and illustrated: Plastic packages with plastic casting, cold-framed metal packages with plastic casting, cast metal packages with plastic casting, capsulation by low-pressure injection molding, and two-part air-cushion capsule made by injection molding with embedded pin system. The limitations and advantages of the various techniques, each capable of being varied in terms of operating parameters, are outlined. Figures 18; references 13: 8 Hungarian; 5 Western.

USSR UDC 621.373.1.029.64

ON CONDITIONS OF INCREASING THE POWER OF SELF-EXCITED OSCILLATORS IN SYNCHRONIZATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1091-1094 manuscript received 20 Apr 76

ANDREYEV, V. S.

[Abstract] The author considers some peculiarities of the energy characteristics of synchronized microwave oscillators. In particular, conditions are determined under which the power of a self-excited oscillator increases under the action of the synchronizing signal. The analysis is based on a model of a self-excited oscillator of quasi-harmonic voltage connected to a synchronizing signal source and a load via a non-reciprocal element. It is assumed that the nonlinear element of the oscillator is a two-terminal network with given vector admittance with respect to the first harmonic. It is shown that under certain conditions when the oscillator is operating in non-optimum conditions (with respect to power), in certain ranges of powers and frequencies of the synchronizing signal the power in the load may exceed the sum of the powers of the autonomous oscillator and the input signal. Figures 3; references 9: 7 Russian; 2 Western.

USSR UDC 621.373.52

INFLUENCE THAT LOADING AND SUPPLY VOLTAGE HAVE ON LOCK-IN OF A GUNN DIODE OSCILLATOR. PHASE-FREQUENCY CHARACTERISTICS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1001-1005 manuscript received 14 Apr 77

ABDRASHITOV, F. R., VOROBEYCHIKOV, E. S. and KULAYEV, S. P.

[Abstract] Experiments are done to determine the phase-frequency characteristics of Gunn diode oscillators. To find the way that the phase shift between the waveforms at the output of the locked-in oscillator depends on the external signal, an installation is used which produces an output signal proportional to the sine of the phase difference and independent of the amplitudes of the rf voltages. The output is displayed on an oscilloscope screen. It is found that the phase-frequency characteristics depend on the operating conditions of the Gunn diode. In the case of a symmetric power-frequency curve, all phase-frequency characteristics intersect at a single point with a phase equal to zero and the frequency of the self-excited oscillations. The phase-frequency characteristics in this case are centrally

symmetric relative to the reference origin. When the power-frequency curve slopes toward lower frequencies, the point of intersection of the phase-frequency characteristics is displaced toward positive phase shifts, while in the reverse case the point shifts toward negative phase shifts. An increase in the load impedance leads to an increase in the limits of change in the phase in the lock-in band. A change in supply voltage also changes the form of the phase-frequency characteristic. In the case where the oscillator deviates from conditions close to optimum, there may be a considerable discrepancy between theoretical and experimental data. In general, the external signal in these cases swings the oscillator into amplification. Figures 5; references 5: 4 Russian; 1 Western.

USSR UDC 621.373.121.15

ON THE THEORY OF RC-OSCILLATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1006-1014 manuscript received 21 Jan 77

DVORNIKOV, A. A.

[Abstract] Contracted first-approximation equations for describing RC-oscillators are derived assuming a low self-excitation margin and low nonlinearity of the active elements. The method of derivation is analogous to that used for multiple-element LC-oscillators by A. A. Dvornikov and G. M. Utkin in a previous paper [see "Radiotekhnika i elektronika," Vol 18, No 8, 1973 p 1657]. The theory covers the case of many active elements in the RC-oscillator. This is necessary not only for actual multiple-element RC-oscillators, but also for single-element oscillators, because it is often necessary to account for the nonlinear input conductance of the three-pole active elements usually taken as the basis for making RC-oscillators. The author thanks G. M. Utkin for continued interest in the work and discussion of the results. Figures 6; references: 10 Russian.

USSR UDC 621.383.292.001.5

NONLINEAR OPERATION OF A PHOTOMULTIPLIER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1319-1322 manuscript received 6 Oct 76

GELIKONOV, V. M. and KHANDOKHIN, P. A.

[Abstract] A mechanism is described for a nonlinear mode of photomultiplier operation in which the photocurrent of the cathode is nonlinearly dependent on the intensity of the incident light. This mode of operation is observed when there is a considerable rise in the density of the flux of light power with focusing on the cathode of the photomultiplier. On the other hand, the output current of the tube may be proportional to the cathode current, i.e., all amplification stages may work in a linear mode. Studies were done on FEU-51 and FEU-53 photomultipliers with a helium-neon laser light source. It is shown that increasing the flux density of optical power on the photocathode surface to several tens of W/mm^2 by focusing the light beam enables double conversion of the optical emission frequency at subcarrier frequencies up to at least 300 MHz. Nonlinear spectral conversion in advance of the input to the multiplier system enables utilization of all the advantages of the multiplier with amplification of the low-frequency signal. Figures 3; references: 4 Russian.

USSR UDC 621.373.82.001.2

ON THE THEORY OF STIMULATED EMISSION IN A CYCLOTRON RESONANCE MASER WITH TRANSVERSE CURRENT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1212-1216 manuscript received 5 Apr 77

ZARNITSYNA, I. G. and NUSINOVICH, G. S.

[Abstract] Stimulated emission is considered in a cyclotron resonance maser with transverse current in which electrons interact with an electromagnetic wave propagating in the direction perpendicular to their translational motion. In the case of reflections from the output end, self-excitation of the maser becomes possible, and if the opposed wave interacts with the electron flux with resultant build-up, self-excitation may arise even when the reflectivity is low. Because the transverse dimensions of this maser are considerable, this system may be used for stimulated emission of relatively powerful signals. It is shown that the reflected wave interacts with the direct wave in tye cyclotron resonance maser with transverse current in a manner similar to the interaction between the opposed waves in other distributed self-oscillatory systems filled with active medium. The conditions of self-excitation are studied, and maser parameters are determined which ensure high efficiency. Figures 3; references: 10 Russian.

USSR UDC 621.375.8

LASER BEAM SHAPING BY NON-CONFOCAL OPTICAL SYSTEMS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 4, 1978 pp 107-111 manuscript received 30 May 77

PAVLOV, V. M., Leningrad Electrical Engineering Institute of Communications imeni M. A. Bonch-Bruyevich

[Abstract] The author considers transformation of a laser beam in a distant plane of observation when there is a change in parameters of the optical system that shapes the laser beam. It is assumed that the laser operates in the TEM_{00} mode. The two-component optical system consists of ideal centered lenses. The laser beam travels along the optical axis without reflection by the components. It is shown that particular attention must be given to precision in setting the predetermined off-axis alignment of the optical system and maintaining this alignment during operation. This paper was recommended by the Department of Electronic and Quantum Devices. Figures 4; references: 6 Russian.

USSR UDC 621.38.032

CONDITIONS OF EXCITATION OF AN OPTRON WITH POSITIVE FEEDBACK WITH DEPLETION-LAYER PHOTODIODE

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 21 No 4, 1978 pp 103-107 manuscript received 7 Jun 77

PRIVER, L. S., Gor'kiy State University imeni N. I. Lobachevskiy

[Abstract] Expressions are derived which describe the kinetics of processes occurring in the photodiode, LED, opamp and optical channel of a positive-feedback optron with depletion-layer photodiode. It is shown that there are two possible modes of excitation of such an optron when the transmission factor is modulated, depending on whether or not the potential difference across the photodiode under the action of external illumination alone exceeds the threshold voltage across the amplifier input beyond which the LED begins to emit. Diagrams of stable optron operation regions corresponding to these two states are given. Experimental results with rapid variation of the transmission factor give qualitative confirmation of the calculations. The positive-feedback optron should be used in devices with light spot scanning such as the pulsed photoelectric microscope where the transmission factor in the optical channel is periodically modulated. This paper was recommended by the University. Figures 4; references: 5 Russian.

USSR UDC 621.382.22.001.5

OPTIMIZING THE OPERATION OF A SILICON POINT-CONTACT DIODE AS A DETECTOR AND MIXER IN THE SUBMILLIMETER WAVE BAND

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1106-1108 manuscript received 12 May 76

DOLGOPOLOV, S. G., KLEMENT'YEV, V. M., KOVALEVSKIY, V. I., MATYUGIN, YU. A. and TIMCHENKO, B. A.

[Abstract] Experiments are done on using a W-Si point-contact diode for direct detection of submillimeter radiation and harmonic mixing of the 12-th harmonic of a klystron oscillator (λ = 4 mm) with the frequency of a hydrogen cyanide laser (λ = 337 μm). The experimental facility included a 10 mW laser, a 4 mW klystron, a mixing band and a system for recording and measuring the intermediate frequency of 30 MHz and the klystron oscillator frequency. In addition, provisions were made for monitoring the laser power and the diode parameters. Curves are given for the rectified voltage and the signal amplitude on the intermediate frequency as functions of the bias voltage and the current-voltage characteristic of the diode, and for the

signal amplitude on the intermediate frequency at zero bias voltage as a function of laser power. It is shown that optimizing the parameters and working conditions of the diode considerably reduces the power consumption of the klystron oscillator and laser. Frequency measurements in the submillimeter range can be made by low-power klystron oscillators and a submillimeter laser with power of about 1 mW. Figures 3; references 5: 2 Russian; 3 Western.

USSR UDC 621.383.5.001.5

ANALYSIS OF DIODE AND TRANSISTOR OPTRON SWITCHING PROCESSES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1094-1097 manuscript received 27 May 76

SIDOROV, A. S.

[Abstract] The author analyzes the governing principles and characteristics of transient processes that arise during rapid switching of quick-response diode and transistor optrons. The switching properties of these devices are examined on the basis of a model which includes photocells controlled by light-emitting diodes. These photocells commutate electric circuits that are connected to a given source of fixed potential. The load is represented by a fixed capacitor. Formulas are derived that can be used to calculate the transient processes that arise with action of current waveforms of various amplitudes and shapes and with different time parameters. An illustrative example is given showing how an optoelectronic stage responds to a steep input current differential of considerable magnitude. Figures 3; references: 2 Russian.

USSR UDC 778.4

RECORDING AND RECONSTRUCTING MICROWAVE HOLOGRAMS IN AN ARRANGEMENT WITH A REFLECTING SCREEN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 931-935
manuscript received 15 Nov 76

KLYUCHNIKOV, A. S. and KURILO, N. I.

[Abstract] An analysis is made of an increase of the effective dimensions of antennas in making microwave holograms that involves using metal screens and the reflecting properties of the ground. The use of such screens is making radioholograms increase their effective area and their resolution. The case of a reflecting screen at an angle of 90° to the aperture of the hologram is considered, and it is shown that recording and reconstruction of the radiohologram in such an arrangement are equivalent to the corresponding operations on a double aperture without a screen. Recording of holograms in the radio frequency range in the proposed arrangement is complicated by the necessity for very exact placement of the optical model of the screen in reconstructing the hologram. In the case of a screen of complicated shape, it should be feasible to reconstruct holograms on a computer using a mathematical model of the screen. Figures 4; references: 2 Russian.

USSR

UDC 621.376.019.4

POTENTIAL INTERFERENCE IMMUNITY OF A COHERENT DETECTOR WITH A LIMITER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 940-947
manuscript received 15 Nov 76; after revision 6 Dec 77

BEZUGLYY, V. V. and ZHUKOV, V. V.

[Abstract] The authors consider the problem of the way that the signal-to-noise ratio is influenced by a band limiter preceding a coherent detector subjected to a harmonic signal and narrow-band- aussian noise. The limiting possible signal-to-noise ratio at the detector output is determined for this case, and the form of the oscillatory characteristic is determined for the limiter that yields this ratio. An investigation is also made of a quasi-optimum detector based on a limiter with abrupt transitions to cutoff and saturation. Figures 5, references 10: 9 Russian; 1 Western.

USSR UDC 535.853:621.38

USE OF AUGER SPECTROSCOPY FOR CHEMICAL ANALYSIS OF THIN-FILM STRUCTURES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 78 pp 46-47

OLEVSKIY, S. S., candidate in physico-mathematical sciences, GOROKHOV, V. N. and ALEKSANDROV, G. V., engineers

[Abstract] The high requirements imposed on the properties of thin-film layers during production of integrated circuits have stimulated the development and use of new research methods which make it possible with great precision to determine the chemical composition of these layers. The special features of the use of the most promising of these methods -- Auger spectroscopy -- in microelectronics are described. In order to investigate the composition of masking coatings, an Auger spectrometer made by the Balzers firm (Liechtenstein) was used with an energy analyzer of a cylindrical mirror type, equipped with an arrangement for ion etching in which the surface of the specimen was bombarded by argon ions with an energy up to 2 kev. Data presented in graphic form clearly illustrate the possibilities of the methods described. Use of Auger spectroscopy makes it possible for technologists operationally to finish off the process of creating semiconductor devices and circuits and to place them into production. Figures 3; references 8: 4 Russian; 4 Western.

USSR UDC 537.533.8

ANGULAR AND ENERGY DISTRIBUTION OF ELECTRONS SCATTERED BY SEMICONDUCTOR GLASS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1315-1316 manuscript received 21 Jul 76

BRONSHTEYN, I. M., YEVDOKIMOV, A. V., STOZHROV, V. M. and TYUTIKOV, A. M.

[Abstract] An investigation is made of the angular and energy distributions of secondary electrons for semiconductor glasses with z_{eff} = 36-43 in the primary electron region of 0.1-1.5 keV and range of angles of incidence of the primary beam of 0-85°. The results show that scattering of electrons in these glasses is analogous to electron scattering with z equal to z_{eff} of the glass. Figures 2; references 9: 5 Russian; 4 Western.

USSR UDC 539.216.2:621.315.592

INFLUENCE THAT ASYMMETRY OF STRUCTURE HAS ON PROPAGATION OF CARRIER WAVES IN THIN SEMICONDUCTOR FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1230-1240 manuscript received 20 Apr 77

BARYBIN, A. A.

[Abstract] An asymmetric thin-film semiconductor structure is considered and dispersion relations are derived for waves of drifting charge carriers in such a structure. The distribution of charge and potential with respect to the thickness of the film is analyzed in the limit of zero diffusion with subsequent consideration of the influence that diffusion has on the structure and dispersion properties of the waves. The dispersion equation for such a structure with strong asymmetry in the zero diffusion limit is similar to that for symmetric modes in a symmetric thin film semiconductor structure. This means that the frequency relations in symmetric and asymmetric structures are fundamentally alike. Asymmetry of the structure has a strong effect on the distribution of charge and field with respect to film thickness. In comparison with zero diffusion, weak diffusion leaves the potential distribution almost undisturbed, but generates another normal mode in addition to the potential wave $\phi_1^{(1)}$, which satisfies supplementary boundary conditions on the film surface. For non-zero diffusion, moving carriers are depleted from the surface regions by the quasi-free boundary, while the rigid boundary enriches these regions with moving carriers. In structures with strong asymmetry, diffusion has the same influence on wave dispersion as in symmetric structures. In this case, the nature of the carrier flux boundary is important only on a film surface in contact with a high-permittivity medium. Figures 4; references 13: 2 Russian; 11 Western.

USSR UDC 621.3.049.77.001.5

INTERACTION OF MICROWAVE-SPIN WAVES AND ELECTRONS IN LAMINAR SEMICONDUCTOR-FERRITE STRUCTURES (A SURVEY)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 897-917 manuscript received 9 Jan 78

GULYAYEV, YU. V. and ZIL'BERMAN, P. YE.

[Abstract] The literature on interaction in laminar semiconductor-ferrite structures between electrons and spin waves in the microwave range is reviewed for the purpose of systematization and preliminary generalization,

and also in order to unify the concepts and techniques that are common to the physics of magnetic phenomena and semiconductor physics. The mathematical theory of laminar semiconductor-ferrite structures is presented. Particular emphasis is given to the part played by heating of electrons in the semiconductor layer, and by straggling effects that control the group velocity and gain under typical conditions. Consideration is taken of the electrical nonuniformity of the dielectric layer in the transverse direction. Nonuniform exchange in a bounded medium leads to wave transformation on the boundary. This yields the specific mechanism of surface wave damping -- the energy of the surface wave is carried away by body waves from the surface into the depth of the medium. The authors discuss experimental research on propagation and the possibility of amplification of surface and body waves, and also studies dealing with arisal of constant emf in the case of ferromagnetic resonance absorption. Figures 10, references 96: 53 Russian; 2 Polish; 41 Western.

USSR UDC 621.315.592

APPEARANCE OF DOMAIN INSTABILITIES IN GUNN-EFFECT DIODES IN A TRANSVERSE MAGNETIC FIELD

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 12 No 6, Jun 78 pp 1179-1183 manuscript received 4 Nov 77; in final edition, 5 Jan 78

KOSTYLEV, S. A., SHABALINA, R. G. and BROVKIN, YU. N., Dnepropetrovsk Division, Ukrainian SSR Institute of Mechanics, Academy of Sciences

[Abstract] Experimental evidence has been obtained that a transverse magnetic field may attenuate rather than amplify the effect of contact inhomogeneities in a Gunn-effect diode. Epitaxial n-GaAs specimens $L \sim 500$ μm long ($L/d = 2-3$) on a semiinsulating substrate were tested, with electron concentrations from $5 \cdot 10^{14}$ to $3 \cdot 10^{15}$ cm^{-3} and electron mobilities from 5000 to 6500 cm /V.s. Ohmic contacts had been produced by condensation of a lead plasma, yielding a contact resistance of $(3-5) \cdot 10^{-4}$ Ω/cm^2. The potential profiles and the voltage-current characteristics were measured in a transverse magnetic field with varying intensity. In one case the threshold current increased monotonically while the threshold voltage first decreased and then slowly increased with increasing magnetic field intensity, as in conventional Gunn-effect diodes. In another case the threshold voltage and the threshold current both increased with increasing magnetic field intensity. In the third case the specimens behaved like those of the second kind in weak transverse magnetic fields and like those of the first kind in strong transverse magnetic fields. An analysis of the results suggests that this anomalous behavior of long Gunn-effect diodes in transverse magnetic fields is essentially attributable to the anomalous manner in which static domains form in the contact zones, where the Hall field is shunted, and thus also to the geometric magnetoresistance effect. Figures 4; references: 3 Russian.

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UDC 621.315.592

PHOTOSENSITIVITY OF GALLIUM ARSENIDE DOPED WITH COPPER

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV, in Russian Vol 12 No 6, Jun 78 pp 1226-1228 manuscript received 19 Jan 78

BELYAKOV, L. V., GORYACHEV, D. N., PARITSKIY, L. G. and SRESELI, O. M., USSR Academy of Sciences, Physico-Technical Institute imeni A. F. Ioffe, Leningrad

[Abstract] The photoconduction effect in a photoresistor with small-scale regular surface roughness is calculated, theoretically, and found to be approximately 20 times stronger with respect to the amount of light absorption in a typical specimen than in one having specularly ground faces. Experiments with copper-doped GaAs photoresistors at liquid-nitrogen temperatures, having a 0.4-0.5 μm deep surface relief and sensitive to light at the λ = 10.6 μm wavelength (CO_2-laser), revealed a somewhat smaller increase in photosensitivity - probably because of the also imperfect surface of smooth specimens. References: 2 Russian.

USSR

UDC 621.382.2

OPTIMIZATION OF CRYSTAL AREA IN MULTIEMITTER POWER TRANSISTORS

Yerevan DOKLADY AKADEMII NAUK ARMYANSKOY SSR in Russian Vol 66 No 2, 1978 pp 91-97 manuscript received 19 Oct 77

AVAK'YANTS, G. M., associate member of the Academy of Sciences, Armenian SSR, PETROSYAN, E. A., MELKONYAN, V. V. and PLUZYAN, Z. B., Yerevan State University

[Abstract] As a basis for economizing on silicon and improving transistor production efficiency, the authors consider the problem of optimizing the size of the silicon plate in multiemitter transistors. Analytical expressions are derived that can serve as a base algorithm for computer solution of the problem. The proposed formulas show the way that minimum crystal area is influenced by the working current, the predetermined current density, current gain in a common-emitter circuit, the geometric parameters of the combs, the effective width of the emitting part of the emitter junction, the width of the base, absolute temperature, resistivity and heat dissipation. A numerical example is given. The proposed technique can be used in LSI design. References: 3 Russian.

USSR UDC 621.382.2

FORWARD BRANCH OF THE VOLTAGE-CURRENT CHARACTERISTIC OF HIGH-VOLTAGE DIODES BASED ON MATERIALS WITH STRAIGHT AND WIDE ENERGY BANDS

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 12 No 6, Jun 78 pp 1149-1153 manuscript received 2 Dec 77

KOROL'KOV, V. I., KONICHEVA, I. M., YUFEREV, V. S. and YAKOVENKO, A. A., USSR Academy of Sciences, Physico-Technical Institute imeni A. F. Ioffe, Leningrad

[Abstract] Gallium arsenide with a high-voltage $p^+-n^0-n^+$ structure is a new material suitable for high-speed high-temperature diodes. Here the concentration profile of excess carriers in the base region and the voltage-current characteristic in the forward region are calculated analytically, taking into account self-absorption of recombination radiation typical of semiconductors with a straight band structure. Radiative recombination in the p^+-region and in the n^+-region is assumed to be negligible, with the nonradiative lifetime of carriers regarded as constant. The differential equation describing the behavior of carrier in the n^0-region has been reduced to one of second degree and it includes a term which accounts for self-absorption of recombination radiation in this region. The boundary conditions are established from the continuity conditions with respect to electron current and hole current at the respective junctions. Numerical results have been obtained by the method of finite differences. The authors thank Zh. I. Alferov for the keen interest in this study, also V. B. Khalfin and B. Tot for valuable comments. Figures 4; references 7: 4 Russian; 3 Western.

USSR UDC 621.382.333.33.001.5

TURN-ON CONDITION OF A p-n-p-n-TYPE SWITCH FOR DIFFERENT DISTRIBUTIONS OF THE INITIAL CHARGE ALONG THE BASES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1039-1045 manuscript received 3 Jan 77

AYAZYAN, R. E., GORBATYUK, A. V. and PALAMARCHUK, A. I.

[Abstract] In determining the turn-on condition of a thyristor, it is convenient to use the concept of efficiency of the initial charge proposed by A. I. Uvarov, which depends on both the magnitude of the charge and the way that the carriers are distributed in the bases. In previous studies, the values of the efficiency factors have been typical of "normal" initial distribution of carrier concentration (where the greater part of the excess

charge of the bases is concentrated near the emitter junctions). Another type of initial distribution occurs when the thyristors are turned off by reverse anode voltage. In this case most of the residual charge at the instant of application of the next forward voltage is concentrated in the vicinity of the collector ("inverse" distribution), and different charge efficiency factors must be used. In this paper the authors calculate these factors for distributions ranging from localized at the collector to linear, and also for uniform initial distribution of excess carriers along the bases. The technique used by A. I. Uvarov is applied to the case of low-level injection in both bases. Formulas are derived for the turn-on condition of a thyristor with initial charge in the bases by the action of short control current pulses. In conclusion the authors thank A. I. Uvarov for interest in the work and construction criticism. Figures 2; references 4: 3 Russian; 1 Czech.

USSR UDC 621.382.333.33.001.5

FORCED PINCHING OF THE CURRENT IN A p-n-p-n-TYPE SWITCH UNDER THE ACTION OF TURN-OFF BASE CURRENT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 5, May 78 pp 1046-1050 manuscript received 23 Feb 76

GREKHOV, I. V., LINIYCHUK, I. A., PALKO, E. V., UVAROV, A. I. and SHULEKIN, A. F.

[Abstract] When a control current lower than the turn-off value is applied to a base of a thyristor in the conductive state, a stable current pinch is formed. The authors study the way that the dimensions of the pinch depend on the base current and electrophysical parameters of the switch with consideration of the currents flowing in regions of the layers outside of the pinch (in the nonconductive part). The analysis is based on a two-dimensional model with high injection level in the bases and coefficients of injection of the emitters equal to unity. It is found that in most instances the processes taking place in the nonconducting part of the switch predominate in determining the dimensions of the pinch. This conclusion is confirmed by experimental data. Figures 2; references 4: 2 Russian; 2 Western.

USSR UDC 621.382.133.015.51.001.5

INVESTIGATION OF ELECTRIC BREAKDOWN OF GALLIUM ARSENIDE DIFFUSION pn JUNCTIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1241-1246 manuscript received 30 Apr 76

GAGKAYEVA, V. V. and MASHNIN, S. V.

[Abstract] Previous studies have shown that breakdown of the pn junctions based on gallium arsenide single crystals occurs along microplasmas. The probability characteristics of the microplasmas must be known to understand the breakdown process. Consequently, the authors study the "turn-on" and "turn-off" probabilities of avalanche pulses of early microplasmas in gallium arsenide pn junctions, and also determine the dimensions and the mechanism of excitation over a wide temperature range. The junctions were made by diffusing zinc into n-GaAs in a vacuum at equilibrium and elevated arsenic pressures. A constant bias was held across the pn junction during the measurements. It is found that the avalanche current transport in the microplasmas is a random pulse process, which is caused by the fluctuations in the number of pairs that arise as a consequence of impact ionization. As the temperature rises, the fluctuations in avalanche current of the microplasmas are suppressed. The charge carriers apparently enter the microplasma region of the pn junctions by the tunnel effect and thermal ionization. The results of the study indicate that copper levels are present in the microplasma region of pn junctions based on single crystal gallium arsenide. Figures 6; references 8: 4 Russian; 4 Western.

HPR

DETERMINATION OF THE DIRECTIONAL CHARACTERISTICS OF THIN-LAYER EVAPORATION SOURCES

Budapest FINOMECHANIKA-MIKTROTECHNIKA in Hungarian Vol 17 No 6, Jun 78 pp 190-192

SZILAGYI, MIKLOS, dr, associate professor, and SZIKORA, BELA, assistant professor, Department of Electronic Technology, BME [Budapest Technical University]

[Abstract] A method is described for the determination of the parameters characterizing the directional characteristics of thin-layer evaporation sources in cases where the source shows cylindrical symmetry. The method is based on an expression containing the total evaporated quantity and the layer thickness formed on a substrate perpendicular to the direction of the evaporation source. Adjustments need to be made to compensate the fluctuating density of the vapor-deposited layer. The data required for this are established on the basis of relatively simple measurements. Approximation may be introduced to make the calculations and measurements simpler with relatively small losses in accuracy. In cases where the directional characteristics of the evaporation source meet a few basic requirements, which they do in most instances, diagrams may be plotted to establish the parameters required for the calculations in a graphic method. In the method developed, emphasis was placed on reducing the number of measurements required for the calculations. Figures 4; references 11: 3 German; 8 Western.

PPR

USE OF ELECTRON BEAMS IN THE FABRICATION OF HIGH-RESOLUTION LITHOGRAPHIC MASKS

Warsaw ELEKTRONIKA in Polish Vol 19 No 3, Mar 78 pp 103-106

PRZYUSKI, JAN: CONDER, KAZIMIERZ and MENDYK, JANUSZ, Institute of General Chemistry and Inorganic Technology, Warsaw Polytechnic Institute

[Abstract] Use of electron beams in lithography makes it feasible to attain a submicron resolution, to automate the drawing process, and to expose a drawing without a mask. The electron-beam exposure system (EBES) resembles a scanning electron microscope with the beam movement controlled by an electric field. It operates in the raster-scan rather than the vector-scan mode, with a pattern produced either by the analog or the digital technique. A drawing is programmed into a computer and accordingly converted to signals which control the beam modulation as well as the beam suppressing

pulses. The maximum beam deflection covers an area of 140 x 140 μm^2 with a possibility of error compensation and a correspondingly small deflection angle - an important feature of the device. The total exposure time for an area of 2 in^2 is 40 minutes. Resist materials used in this process must be very sensitive, have a high resolving power, and fit the technology in terms of adhesion as well as resistance to etchants. The best polymer materials in use now are the grade P(GMA-Co-EA) for negative resists and butenyl-1 sulfone for positive ones. Figures 6; tables 1; references 16: 1 Polish; 15 Western.

USSR UDC 538.541

ESTIMATES OF EDDY CURRENT LOSSES

Novocherkassk IZV.VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 362-374 manuscript received 30 Aug 76; after completion 20 Jul 77

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[Abstract] The author finds a priori estimates of eddy current losses in nonhomogeneous and anisotropic conductors. Estimates of the upper and lower bounds are found for uniformly and isotropically conductive closed shells. An iterative method is proposed for calculating the distribution of eddy currents and the convergence of the method is established. Estimates are found that are applicable to both sinusoidal external fields and arbitrarily varying fields. The estimates and the proposed method should be used in the case of weak or moderate manifestation of the surface effect. In the case of a pronounced surface effect, another approach is needed that is based on application of approximate boundary conditions: conditions of ideal conductivity or M. A. Leontovich's impedance boundary conditions. A convergent iteration process similar to that proposed in this paper can also be constructed for thin-walled plates and shells and realized with the use of a stream function. Figures 1; references: 8 Russian.

USSR UDC 62-83:621.313.323

PULSE EXCITERS FOR MICROMACHINES WITH MAGNETIC EXCITATION

Moscow ELEKTRICHESTVO in Russian No 6, Jun 78 pp 78-80 manuscript received 5 May 77

DELEKTORSKIY, B. A. and TARASOV, V. N., Moscow Power Engineering Institute

[Abstract] A device was proposed earlier by the authors for regulating the rotor magnetization in a synchronous electric micromotor. This auxiliary pulse exciter operates on the premise that the electromagnetic energy transmitted to the rotor of a machine during magnetization and magnetization reversal depends, in the first approximation, only on the amplitude and not on the duration of a current pulse, while the energy loss in the rotor core is proportional to the pulse duration. Accordingly, the exciter as well as the rotor air gap and winding distribution are designed for a voltage pulse of maximum possible amplitude and minimum possible duration, i.e., maximum power. This auxiliary excitation source also includes a capacitor, low-power charging circuits and high-power discharging circuits with appropriate switches, and a control system with extra switches for matching the pulse

exciter with the main exciter without mutual shunting. Connecting the pulse exciter across only two motor phases is the best tradeoff, which eliminates the need for two diodes and one of two controlled power switches in order to prevent the magnetizing pulse current from also flowing through the main exciter. This device was checked on several micromotors with a stator bore of 35 mm and a coercive force up to 30 kA/m. The principle should also be applicable to d.c. micromotors and to microgenerators with voltage stabilization. Figures 2; references: 6 Russian.

USSR UDC 621.34.001.1

EVALUATION OF THE STRUCTURAL RELIABILITY OF SMALL ELECTRIC MACHINES

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 394-398 manuscript received 26 Nov 75

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[Abstract] A procedure is presented for quantitative evaluation of the structure reliability of various types of small electric machines considered as systems of parts connected in series. Formulas are given for determining the reliability of the main components -- bearings, brush system, collector and contact rings, windings and magnetic system -- and the reliability of the system as a whole as the product of the no-failure probabilities of the separate components. A numerical example is given of application of the procedure to calculating the structural reliability of a small DC motor. It is pointed out that the confidence of the resultant estimate increases as the quantitative data on failure rate of the separate parts of the machine come closer to the true figures for the given type of machine. References: 5 Russian.

USSR UDC [621.313.62-83:629.1.037]001.24

INVESTIGATION OF NONCONTACT COUNTER-ROTARY CASCADE WITH SYNCHRONOUS GENERATOR

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian No 2, Mar-Apr 1978 pp 107-112 manuscript received 19 Oct 76

PARFENOV, E. YE. [deceased] and ALEKSEYEV, S. A., Leningrad

[Abstract] An analysis of experimental and theoretical investigations of coaxial oppositely rotating screw propellers (PVGV) reported in the literature makes it possible to consider them as the most promising form of propelling device for ships which are equipped with propulsion plants of large power. One of the serious problems connected with the use on ships of coaxial PVGV is the development of an efficient means for transmission of power from the prime engine to the propeller. Because a noncontact counter-rotary cascade with a synchronous generator is of great interest in this connection, the present paper discusses the basic relations, and a power diagram is shown of the noncontact cascade of electrical machines which contain a synchronous generator and an asynchronous electrical motor realized as a machine of double rotation. The experimental investigations on a model described in the literature [I. D. Urusov, Izv. AN SSSR. Energetika i transport, 1974, No 3], in order to obtain a quantitative test of the principal theoretical positions, confirmed their accuracy. The specific properties and advantages of the cascade as an autonomous electric drive of dual mechanisms with a fan-driven load are indicated. Figures 5; references: 3 Russian.

USSR UDC 621.314.029.64

ON ANALYSIS OF PHYSICAL PROCESSES IN THE TRANSITION REGION OF A CYCLOTRON ENERGY CONVERTER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 23 No 6, Jun 78 pp 1217-1223 manuscript received 23 Jun 77

VANKE, V. A., ZAYTSEV, A. A., LOPUKHIN, V. M. and SAVVIN, V. L.

[Abstract] Computerized numerical modeling is used to analyze the influence that the radius of the electron flux has on the process of converting rotational energy of an electron beam into longitudinal energy for different magnetic field configurations in the transition region of a microwave cyclotron energy converter. A comparatively wide range of input parameters is considered for both reversible and diverging magnetic fields. It is shown that for a given length of the transition region, the optimum magnetic field configuration depends on the relative radius of the electron flux.

For low values of the normalized length of the region of the changing magnetic field the optimum magnetic field parameter depends more strongly on the flux radius, and this dependence decreases considerably for greater lengths. It is demonstrated that efficiencies of 90 percent can be achieved in converters with a power of 1-50 kW. The part played by Coulonb interaction is estimated, and it is shown by a specific example that the space charge plays a comparatively small part in the process of conversion of transverse energy of the beam into longitudinal energy for the case when the magnetic field induction at the input to the interaction region is equal to about 1.5 times the Brillouin value. Figures 3; tables 1; references 4: 3 Russian; 1 Western.

USSR UDC 621.314.372

APPLICATION OF WALSH FUNCTIONS TO ANALYSIS OF THE FREQUENCY RESPONSES OF PULSE-DURATION CONVERTERS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 418-426 manuscript received 9 Sep 75, after revision 15 Nov 76

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[Abstract] In analyzing and synthesizing automated power supply systems with pulse-duration converters it becomes necessary to represent them as elements of an automated control system. It is shown that development of methods of analyzing systems with pulse-duration modulation amounts to finding the equivalent replacement of duration modulation by amplitude modulation without restricting the limits of motion of the coordinates of the automatic control system. The author considers the feasibility of using a complete system of orthogonal Walsh functions for equivalent substitution of PAM for PDM, concentrating attention on the pulse-duration converter. A converter with linear modulation characteristic is considered. It is shown that the process of pulse-width modulation reduces to pulse-amplitude modulation of the Walsh coefficients. The proposed approach is used for analyzing the frequency responses of the converter, and it is shown that the method is applicable to analysis of the frequency responses of barrier-layer converters. Figures 4; references: 6 Russian.

USSR UDC 621.318.13+518.62

ON APPROXIMATING MAGNETIZATION CHARACTERISTICS IN DIGITAL COMPUTER CALCULATIONS OF TRANSIENT PROCESSES IN ELECTRIC MACHINES AND TRANSFORMERS

Novocherkassk IZV. VUZ: ELEKTROMEKHANIKA in Russian No 4, Apr 78 pp 357-361

FIL'TS, ROMAN VLADIMIROVICH, candidate in technical science, senior scientific worker, UkrSSR Academy of Sciences, Institute of Mathematics; GAVRILYUK, ROMAN BORDANOVICH, candidate in technical sciences, dotsent, Ivano-Frankovskiy Institute of Petroleum and Gas; and PLAKHTINA, YEMEL'YAN GRIGOR'YEVICH, assistant, L'vov Wood Technology Institute

[Abstract] The authors consider the problem of numerical approximation of transient processes with consideration of the requirement for minimizing machine time in integrating nonlinear systems of differential equations. It is shown that the differential magnetization characteristic is used in calculating the transient process rather than the initial magnetization characteristic. An investigation is made of the effect that absence of higher derivatives (or all derivatives) at the joints of piecewise approximations of magnetization characteristics has on machine time in calculation by the fourth-order Runge-Kutta method. It is shown that when digital computers are used, the calculation of transient processes requires a simple algorithm for determining the coefficients of the approximating function (rather than a small number of arithmetic operations) and minimum time for calculating the transient process (rather than minimum time for approximating the magnetization characteristic). For low-accuracy calculations, it is advisable to use piecewise-linear approximations of the differential magnetization characteristic, which corresponds to approximating the initial magnetization characteristic by sections of second-order parabolic curves with first derivatives at the knots. In this case, discontinuities of higher derivatives at the joints of neighboring polynomials have almost no influence on increasing machine time when the Runge-Kutta method is used. When integration accuracy is to be improved, it is necessary to increase the number of derivatives at the joints to a number which in the limit approaches the number of derivatives required by the numerical integration method being used. References: 6 Russian.

USSR UDC 621.365.5.001.24

ANALYTICAL DESIGN OF CYLINDRICAL INDUCTION-HEATING SYSTEMS

Moscow ELEKTRICHESTVO in Russian No 6, Jun 78 pp 43-47 manuscript received 21 Sep 77

LUPI, S. and NEMKOV, V. S.

[Abstract] The performance of inductor systems for heating long solid or hollow cylinders is calculated here on the basis not only of the integral inductor parameters but also the electromagnetic field and power distributions. A two-layer cylindrical load is considered, for illustration, either inside or outside the periodically distributed inductor winding, with the magnetic components assumed to be lossless and of a high permeability. From the equations of the vector potential expressions are derived for the electric field intensity, the magnetic field intensity, the power in the load, and the inductor impedance. Special cases of practical interest include inductors connected opposing, single inductors, and two coaxial inductors of different lengths. A computer program has been devised for calculating design curves showing, for instance, how the mode of heating is affected by the absence or the presence of a magnetic core. Figures 4; tables 1; references 9: 4 Russian; 2 Polish; 2 German; 1 Western.

PPR UDC 621.317.724

PRINCIPLES OF CALCULATING THE MAGNETIC COMPONENT OF THE VOLTAGE INDUCED BY LIGHTNING: SUPPLEMENT TO THE ARTICLE IN VOL 23, 1974 (p 1023)

Warsaw ARCHIWUM ELEKTROTECHNIKI in Polish Vol 26 No 4, Oct-Dec 78 pp 875-877
manuscript received 25 May 77

JAKUBOWSKI, JANUSZ LECH, Warsaw Polytechnic Institute

[Abstract] The author confirms the conclusions reached by C. Singarajah and D. J. Harris (Proc. Fourth Internat'l Confer. on Gas Discharges, IEE No 143, 1976) with regard to the problem of calculating the magnetic component of the voltage induced in a conductor by lightning. Their equation, a nonhomogeneous differential wave equation, also takes into account the effect of streamers. It is nevertheless an extension of the equation first derived by A. Ya. Dolginov (ELEKTRICHESTVO in Russian, No 10, 1949; No 12, 1950), which recognizes the essential fact that, unlike the electric component along the conductor axis, the magnetic component is normal to the conductor axis. References 9: 1 Polish; 4 Russian; 4 Western.

USSR UDC 629.199.05.004.69

MODERNIZATION OF AMPLIFIERS OF REGULATING SYSTEM OF TYPE 3001 CHAMBER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 78 p 41

YELISEYEV, B. A. and SOLOV'YEV, V. A., engineers

[Abstract] After a duration of exploitation (more than five-six years) the GDR-produced Type 3001 climate chamber which is intended for conducting tests of goods, newly under development and of series produced goods for heat-cold-moisture resistance and stability, difficulties in the maintenance of the chamber's work capacity appear, which account for an increase in the number of failures of the electric system of regulation. The steps necessary for modernization of the amplifiers of the regulating system of the chamber are described.

USSR UDC 061.3:621.3

TRENDS IN THE DEVELOPMENT OF APPARATUS FOR DIRECT-CURRENT POWER TRANSMISSION

Moscow ELEKTRICHESTVO in Russian No 6, Jun 78 pp 69-72 manuscript received 18 Jan 78

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[Abstract] New concepts indicative of the trends in d.c. power transmission were reported to BELK [?Worldwide Conference on Power Lines] held in Moscow in June 1977. The directions in which converter substations are being improved, with respect to capacity and reliability, include a preference for parallel connection of rectifier bridges and for graded insulation systems. Other concepts not yet quite economically feasible are increasing the number of a.c. phases to 24 and 36, forced commutation at negative firing angles, replacement of transformers with capacitors, and replacement of thyristors with diodes where reliability and dynamic characteristics are not most critical. Innovations are made in the control of d.c. power lines, in the design and the protection of rectifiers and transformers, in the use of d.c. dischargers, kvar compensators of the rectifier-reactor-inverter version, and high-voltage vacuum-type d.c. circuit breakers. On the basis of these reports, it can be predicted that development of high-voltage thyristors together with a lower cost, a smaller size, and a higher reliability of converter substations will accelerate the installation of d.c. transmission lines during the next few years. References 10: 6 Russian; 4 Western.

USSR UDC 621.311

PROBLEM OF CREATING A UNIFIED POWER SYSTEM FOR THE USSR AND LONG-DISTANCE POWER TRANSMISSION OF SUPER-HIGH VOLTAGE (RESULTS OF SCIENTIFIC RESEARCH ACTIVITIES OF DR IN TECHNICAL SCIENCES S. S. ROKOTYAN [deceased])

Moscow IZVESTIYA AKADEMII NAUK SSSR: ENERGETIKA I TRANSPORT in Russian No 2, Mar-Apr 1978 pp 140-147 manuscript received 18 Jan 78

BESCHINSKIY, A. A., YERMOLENKO, V. M., ILLARIONOV, G. A., LEVITSKIY, K. K. and LYSKOV, YU. I.

[Abstract] Sergey Sergeyevich Rokotyan, dr in technical sciences, Laureate of the Lenin Prize, Chief Engineer of the Order of the October Revolution All-Union State Planning, Surveying and Scientific-Research Institute of Power Systems and Electric Power Networks, died on 28 Nov 77 in his 70th year. The principal landmarks in the creation of large-scale power associations and long-distance transmission of super-high voltage, which have

provided the leading position of the USSR in these forms of electrical power development, are connected with the name of S. S. Rokotyan. His scientific-research activities during the course of his professional career are described in some detail.

USSR UDC 621.311-52.001.24

IDENTIFICATION OF FAULTS IN ELECTRIC POWER SYSTEMS

Moscow ELEKTRICHESTVO in Russian No 6, Jun 78 pp 9-14 manuscript received 15 Dec 77

BOGATYREV, L. L., candidate in technical sciences, Ural Polytechnic Institute

[Abstract] Identification of various fault conditions is essential in the automatic control of electric power systems. Any class of faults is defined by a set of parameters characterizing the normal mode of operation, the state of the electric power system, and the mode of perturbation. The entire set of parameters (symptoms) characterizing a fault condition can be subdivided into quantitative ones expressible numerically, qualitative ones expressible in ranks, and nominal or classifying ones in terms of binary-logic variables. It is generally desirable to minimize the volume of the symptom space and to select the most informative parameters within this space so that the control problem can be solved without a substantial increase of the loss function. Algorithms for fault classification are best based on a probability analysis and on methods which will ensure the minimum identification error with the least number of gradations of qualitative symptoms. Inclusion of binary-logic symptoms is found to reduce the identification error. Figures 2; references 8: 7 Russian; 1 Western.

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UDC 621.315.052.5.001.5

DEVELOPMENT OF THE APPARATUS COMPLEX FOR THE EKIBASTUZ-CENTER 1500 kV D.C. ELECTRIC POWER TRANSMISSION LINE

Moscow ELEKTROTEKHNIKA in Russian No 6, Jun 78 pp 1-6

FOTIN, V. P., Director, All-Union Institute of Electrical Engineering imeni V. I. Lenin

[Abstract] Construction of the Ekibastuz-Center 2400 km long 1500 kV d.c. electric power line capable of transmitting 37 billion kW·h annually began in 1978. The substation design is based on the use of high-voltage thyristors (1500 V - 320 A, 2500 V - 320 A, 2700 V - 620 A) with reliable laser control through fiber optics, high-power voltage transformers (160 kV - 525 MVA), an insulator system with minimum exposure to atmospheric effects, and appropriate cables. With the voltage rating about twice as high as that of the Volgogorod-Donbass line and the Nelson River-Winnipeg line (Canada), the number of converter bridges could be reduced to half. With the 12-phase converter system retained, furthermore, it was also possible to eliminate bridge shunting commutators and special d.c. busbars. A 10 percent saving in substation equipment is anticipated. A major problem is increasing the number of conductors per terminal from four to six or eight. Figures 10; tables 1.

CSO: 1860

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